THE TELEGRAPHIC JOURNAL AND

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THE VIENNA ELECTRICAL EXHIBITION.

ALTHOUGH in picturesque effect the Vienna Electrical Exhibition exceeds anything of the kind yet attempted, nevertheless it cannot be compared in importance with its greater predecessor held at Paris. The exhibits of electrical apparatus is by no means a scanty one, yet from the absence of decided novelties it necessarily lacks the interest which the Paris display excited; moreover, following as it does so soon upon the heels of the latter, and also being held at a locality which is rather out of the beaten track, it could hardly be expected to excite very great attention from the general public or even from the manufacturers of Northern Europe. The exhibition, like that at Munich, has, however, afforded an opportunity to many exhibitors from the south of the Continent of bringing themselves to notice, and considerable advantage has been taken of it.

Taking the exhibition as a whole there are but few novelties to be found in it, and it must be said that but little sign of progress beyond what the Paris Exhibition showed, can be observed. Most of the exhibits are those of well-known standard forms of apparatus, manufactured in all cases with a great degree of excellence, as regards outward finish at least. The reputation which Vienna has for its artistic cabinet-work is fully displayed in the instruments manufactured by Viennese firms; indeed, the Austrian displays generally are all noticeable for the excellence of their cabinet-work. The most important consideration in electrical apparatus is, of course, that it should work well, but, unfortunately, in the case of the Vienna installation there is not a very general tendency to show the apparatus in actual work, or, indeed, to afford opportunities of testing it; consequently, it is difficult, if not impossible, to pass a satisfactory verdict upon the most essential qualities of the articles shown. There are, for instance, a considerable number of exhibitors who show neatly-arranged coils of wire insulated with gutta-percha or other moisture-resisting material. Now, those who have had experience in wire of this kind know well how utterly delusive mere outward appearance is; the insulated wire which outwardly may be all that can be desired, may, at the same time, be utterly useless for the purpose for which it is intended, owing to its being electrically defective and not able to stand the most ordinary test to which it might be submitted. An insulating material with a smooth and uniform outer surface and of an apparently homogeneous character may be full of faults which 24 hours' soaking in water at 75° F. and a test with 200 Leclanché cells, would quickly develop.

Displays of electric light and battery carbons are also fairly numerous, as are also exhibits of porous jars for batteries and specimens of insulators. An homogeneous structure, compactness of grain, and purity of substance, are in electric light carbons very essential features, but these a mere outward show cannot guarantee, nor can it prove that the carbons when employed for battery purposes will not fall to pieces after continued use. In the matter of porous battery jars, uniformity of porosity and of electrical resistance are important points, especially for telegraphic purposes, otherwise, from the porosity being too great, considerable local waste of the separated liquids in the battery will take place, or, on the other hand, if the porous material is too hard, the working electric current becomes very much weaker than it should be.

Of the porcelain insulators it is easier to judge, the ware in all cases where exhibited having an excellently glazed surface; this latter point is of much more importance than that the body of the material should be of a high quality; it is, however, necessary that the substance should be homogeneous and dense for mechanical though not for electrical reasons. Although the outward quality of the ware for the insulators is decidedly good in all cases, the same cannot be said of many of the shapes shown, the latter being very often both wonderful and fearful. It would seem as if the continental telegraph systems were peculiarly exempt from the trouble of broken insulators, as the methods of fixing the same appear as if they were designed to give as much trouble as possible when renewals or cleaning have to be effected, the porcelains being firmly cemented to iron bolts which are either screwed direct into the pole or else fastened with several bolts. In some cases, indeed, a number of insulators are arranged in a frame, the bolts of the former being rivetted to the same, so that renewals of broken porcelains are impossible unless the whole frame is removed, which operation, moreover, can only be effected by cutting nearly all the wires.

Considering the extremely small use which is made of electric clocks it is somewhat surprising to find the number of exhibits of this kind which we always observe at electrical exhibitions; this was particularly noticeable at Paris, and at Vienna a large number are to be found. The ingenuity shown in these contrivances is very great, but, unfortunately, it seems almost thrown away. The actual value of a clock driven by a battery as compared with one driven by a spring or weight, has never yet been shown to be great, and no matter how ingenious and effective are the contrivances by which the object aimed at is carried out, the labour expended on it is practically lost.

Of electro-medical appliances there is a good show; in this description of apparatus foreign countries excel, though there are signs that England is waking up to the necessity of more systematically dealing with the general subject than has hitherto been the case. Some ingenious dental instruments worked by small electro-motors are amongst the exhibits.

Although Great Britain is still a long way ahead in

the department of appliances for electrical measurement, yet there is a general tendency for foreign firms to do something in this direction. As a rule, but little originality is displayed, the sets of resistance coils, &c., being generally copies of the well-known English patterns, and in most cases where any attempt has been made to effect alterations, the results have not been happy ones. Of the accuracy with which the adjustments of the coils, &c., have been made, no opinion can be expressed, and therefore, although the outward finish and arrangement may be good, it would not be safe to commend any form of testing apparatus as being of high merit unless the most important essential element of all, that is accuracy of adjustment, was known to be satisfactory. Of galvanometers there are a considerable number shown, but almost all are of the ordinary suspended astatic double-needle type; reflecting galvanometers of the Thomson pattern are conspicuous by their absence.

(To be continued.)

BOYS' ELECTRICAL ENGINE POWER METER.

ON several occasions we have spoken of the meters of Mr. C. Vernon Boys, and in the ELECTRICAL REVIEW for March 24th, 1883, we published a lecture delivered by that gentleman, entitled "Meters for Power and Electricity," furnished with diagrams, and including that which we now illustrate more completely. This meter is designed to obviate the necessity for the calculations which must be entered into in order to ascertain, from indicator diagrams, the power an engine is exerting. The instrument keeps a continuous automatic record of the power given out by an engine, and its performance at different intervals can be read off on a

FIG. 1.

dial. The patents for this apparatus are in the hands of the Electrical Trading Company, to whose courtesy we are indebted for a loan of the meter here illustrated. As we have not had an opportunity of seeing one attached to an engine and in operation, we take advantage of a description given in our contemporary, the *Mechanical World*, the representatives of which journal have had the good fortune to examine into the working of a meter fixed to an engine at the works of Messrs. Lancaster & Tonge, of Pendleton, Lancashire.

Figs. 1 and 2 represent the instrument complete, the latter having the attachment fixed for taking diagrams, and the former being in the form for the simple recording of power. Fig. 3 is a simple diagram to show the parts in an elementary form, and to show the action clearly; and by comparing the latter figure with the other two the corresponding parts will be readily identified. The instrument is mounted so that the branch, U, on the under side of the piston, N, is in connection

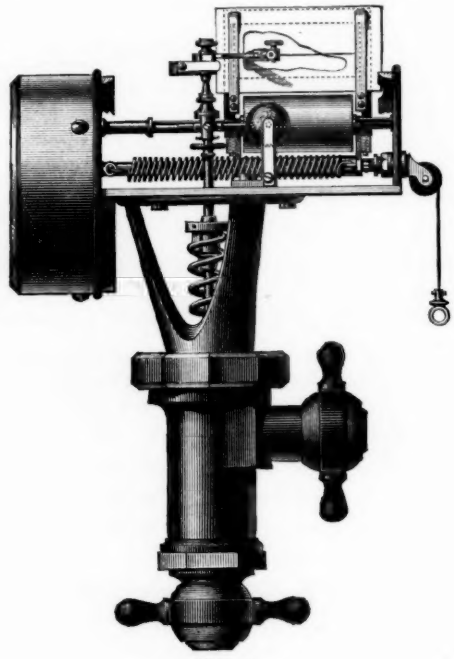


FIG. 2.

with the engine cylinder at the end opposite the piston rod, and the branch, T, is put in communication with the other end of the engine cylinder. Fig. 4 shows its

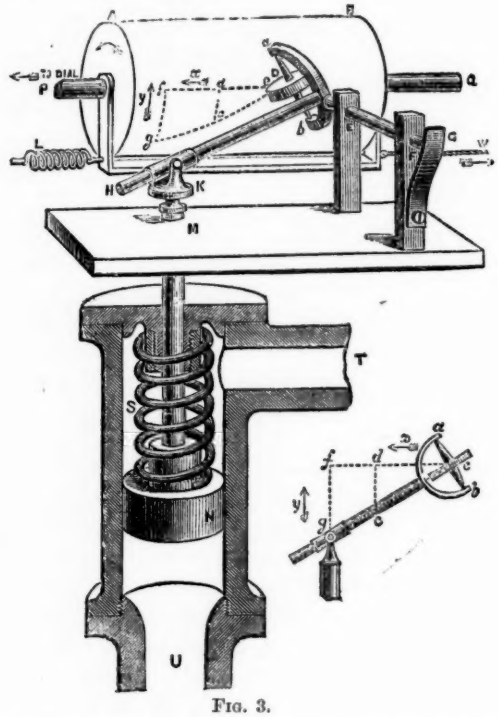


FIG. 3.

application to a cylinder. The wire, W, fig. 3, is connected to some piece of mechanism, which is made to reciprocate with a motion corresponding to that of the engine-piston, but of course reduced down to a short stroke to suit the instrument, and the alternate pulls of the wire, W, and the spring, L, move the "integrating"

cylinder, A, B, to and fro simultaneously with the engine-piston. At the same time the piston, N, of the instrument is moved up and down by the alternate pressing and exhausting of steam above and below it, the amount of motion being governed by the strength of the spring, S. At the top of the piston-rod, M, a swivel socket, K, is mounted, through which the arm, H, is free to slide during the vibrations of the piston. The arm, H, is rigidly connected with the fork, *a*, *b*, which carries a small wheel, D, called the "tangent" wheel. A flat spring, G, presses against the end of the spindle, E, F, upon which the fork, *a*, *b*, turns, and keeps the tangent wheel in contact with the cylinder, A, B.

It has been pointed out that a reciprocating motion, exactly similar to and simultaneous with that of the engine-piston is imparted to the integrating cylinder, A, B; but this cylinder obtains also a rotary motion by the following means. It will be understood that if the arm, H, and therefore the plane of the wheel, D, is in its normal position, *i.e.*, horizontal, as shown in fig. 2, the line, *e*, *f*, is that along which the wheel will roll when the cylinder is pulled forward by the wire, W, and that no rotary motion of the cylinder will result. This is exactly what happens when there is no pressure of steam either above or below the piston, N, of the instrument; but, supposing both the branches, T and U, are in open connection with the engine-cylinder, from which at the end open to U steam is being exhausted, and into which at the end open to T steam is being admitted, then the piston, N, and therefore the end, H, of the arm, will be depressed. The plane of the tangent-wheel, D, will now be inclined as shown in fig. 3, and during the forward motion of the integrating cylinder, A, B, the friction due to the contact between the polished surfaces of the wheel and cylinder will be sufficient to compel the latter to rotate on its axis, the line of contact being *e*, *g*. This rotary motion will be greater or less according as the angle, *f*, *e*, *g*, is greater or less, and is always proportionate to the work done during the corresponding stroke of the piston. The spindle, P, Q, by means of mechanism with which it is in connection, thus registers, on the dial shown in fig. 1, the amount of work continuously being performed by the engine.

It must be understood that no lines of any kind are drawn on the cylinder by the wheel as shown in fig. 3, their use on that sketch being simply for our purposes of illustration. The line, *f*, *g*, being a tangent to the angle, *f*, *e*, *g*, gives to the wheel, D, the position of which determines it, the name "tangent" wheel, and, inasmuch as this tangent of the angle of rotation is proportional to the displacement of, and therefore measures the pressure on, the meter-piston, and the horizontal motion of the integrating cylinder is proportional to the motion of the engine-piston, it follows that the amount by which the cylinder rotates is exactly proportional to the product of the pressure on the engine-piston, multiplied by the distance through which the latter moves, and is therefore an exact measure of the work done by the engine. At first sight it might appear as though the return stroke of the integrating cylinder would reverse its rotation and undo the record; but this is not so, because at the end of every stroke the inclination of the tangent wheel is of necessity reversed by the admission of steam to the opposite side of the piston, and thus the rotation of the integrating cylinder progresses continuously at a rate proportional to the work done in the engine.

By comparing the number of units registered on the dial in any given time with the number registered during a similar period when the engine was known to have been working satisfactorily, the performance of the latter can be watched and controlled; but in order to obtain the amount of work, in foot pounds, done in any given time, it is necessary to obtain the number of foot pounds represented by one unit of the meter, which number of necessity varies with the dimensions, &c., of the engine to which it is applied. This, however, when once found is found for all. The makers determine for and mark on each instrument a constant, *c* (=0·105),

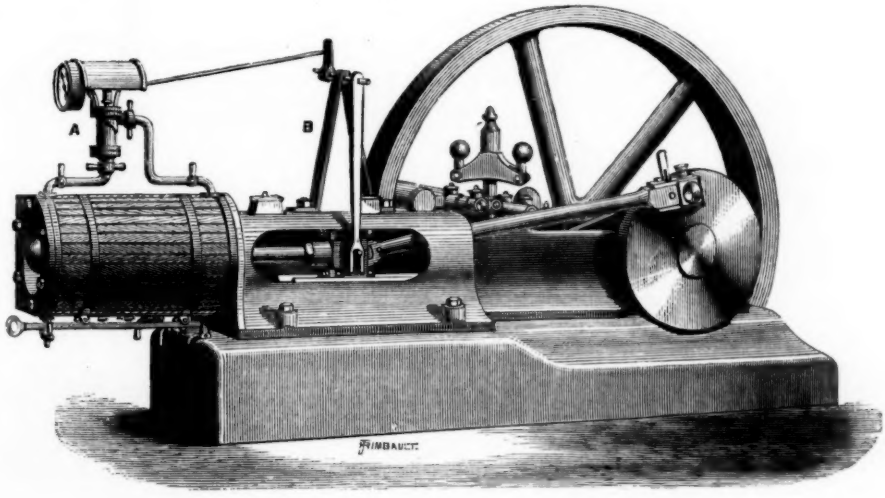


FIG. 4.

which is used in the following formula for obtaining the number of foot pounds just mentioned:—

$$W = \frac{M}{n} \times D^2 \times s \times c =$$

the number of foot pounds represented by one unit of the meter; when M = stroke of engine, *n* = stroke of integrating cylinder (a ready means for obtaining which is provided on the instrument), D = diameter of engine cylinder, *s* = a number or constant given to the spring by the makers, and *c* = the constant already referred to. When the number, W, is found by this formula it is only necessary, in order to determine the amount of work in foot pounds done in any given time, to multiply it into the number of units registered during that given time. To determine the horse-power of the engine at any particular time, the number, W, must be multiplied by the number of units registered in a minute, and the product must be divided by 33,000.

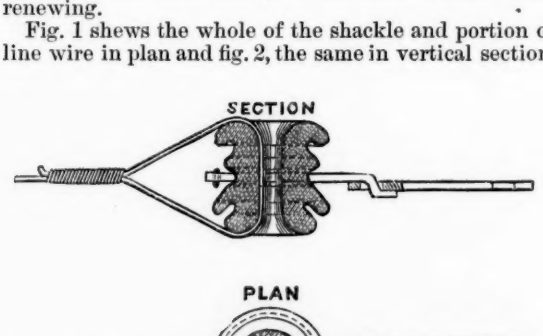
For taking a small diagram in order to ascertain the working of the valves, the special attachment provided consists, as shown in fig. 2, of a card-clip, which drops into position on the reciprocating saddle of the integrating cylinder, and a pencil-holder, which screws into the top of the piston-rod. It will thus be seen that the instrument is at once an indicator and a continuous recorder of power. In the latter capacity it is perfectly automatic, and of special value to users of either steam, hot-air, water, or gas-engines, to all of which it is applicable.

We have rarely seen better specimens of workmanship than that exhibited in these meters, and we understand that a number are already in use. Engineers desirous of seeing one of the prettiest instruments we can call to mind, both mechanically and electrically speaking, would find a visit to the company one combining both pleasure and profit.

LEWIS'S PATENT TELEPHONE SHACKLE.

AMONGST the few decided novelties exhibited at the Vienna Exhibition, not the least noticeable is the excellent and ingenious form of binder for insulators, devised by Mr. Slater Lewis, of Birkenhead. A description of this binder was given in the number of the ELECTRICAL REVIEW for Nov. 11th, 1882. Mr. Lewis also exhibits a new form of shackle, which is a very great advance on anything of the kind yet brought out, and is admirably adapted for the purpose for which it is designed. This shackle has been designed with a view to supplying telephone engineers with a cheap, handy, and yet efficient terminal insulator—one that will be found adaptable to all the positions met with in erecting wires in towns and over house tops, and one that will give the least trouble when renewing.

Fig. 1 shews the whole of the shackle and portion of line wire in plan and fig. 2, the same in vertical section.



It will be seen that, there being only one strap, the shackle can be bolted to a cross arm or to a saddle-top or bracket without any of the complications usually seen where the two straps of the Bright shackle are used; and, should the porcelain be broken and require replacing the change can be effected with the least possible trouble and without having to unscrew any bolts, as in the case of the Bright shackle.

Where a number of wires are arranged round a chimney, a very neat, strong and cheap arrangement can be brought about by the use of this insulator. Four lengths of angle iron are formed into a square frame, and holes are drilled at convenient distances therein, into which the shackle straps can be hooked at any desired point; thus the flat strap and bolt are saved in each shackle used. The shackle is also admirably adapted for terminating on the strand process. The surface taken up by both line-wire and strand are absolutely without any sharp corners, which are so liable to cut the strand wire by the lateral movement of the insulator in windy weather.

One point of importance is that the porcelain portion is suited to the Bright shackle straps, so that, where the invention is adopted, two kinds of insulators need not be carried about.

The porcelain portion is very neatly and well made by Messrs. Doulton & Co., of Burslem.

The Brighton Electric Railway.—This railway, we note, was greatly damaged by the storm of Sunday, the rails, although close up to the parade, being distorted in a most extraordinary manner.

GÉRARD'S ELECTRIC CANDLE.

ACCORDING to a description published in the *Revue Industrielle*, this candle has no regulating mechanism. A fixed carbon is inserted in a socket connected with one terminal of the apparatus; the other terminal is connected with two iron cups, cone-shaped at the bottom and filled with mercury.

Into these cups dip two stems, also of iron, of which the points rest upon the bottom of the cones; these stems are connected by a bar provided with a socket for holding another carbon similar to the first.

It will be seen that these two points resting upon the bottom of the cups form a movable frame which is influenced by the slightest external causes tending to make it oscillate.

The mercury serves, in the first place, to establish an excellent contact with the stems and also by its hydrostatic pressure, to render the mechanism very sensitive.

The apparatus is so arranged that the equilibrium of the movable carbon is disturbed so that it always leans against the fixed carbon.

This circumstance allows of re-lighting. As two parallel currents in opposite directions repel each other, the movable carbon retreats from the fixed carbon and the arc is formed at the point of the carbons where it remains until the rods are consumed.

If by any cause whatever the arc is extinguished, the movable carbon. being no longer repelled, falls upon the fixed carbon and re-establishes contact, which allows the arc to be again formed.

This candle works equally well with the points downwards; the arc is kept at the points without necessitating any arrangement such as a directing-frame or an electro-magnet.

An arrangement precisely similar to this was devised by Mr. Robert Sabine, C.E., some years ago, and we published a short article in the ELECTRICAL REVIEW for July 15th, 1882, entitled "The Influence of Electric Currents upon each other," in which Mr. Sabine's apparatus was described.

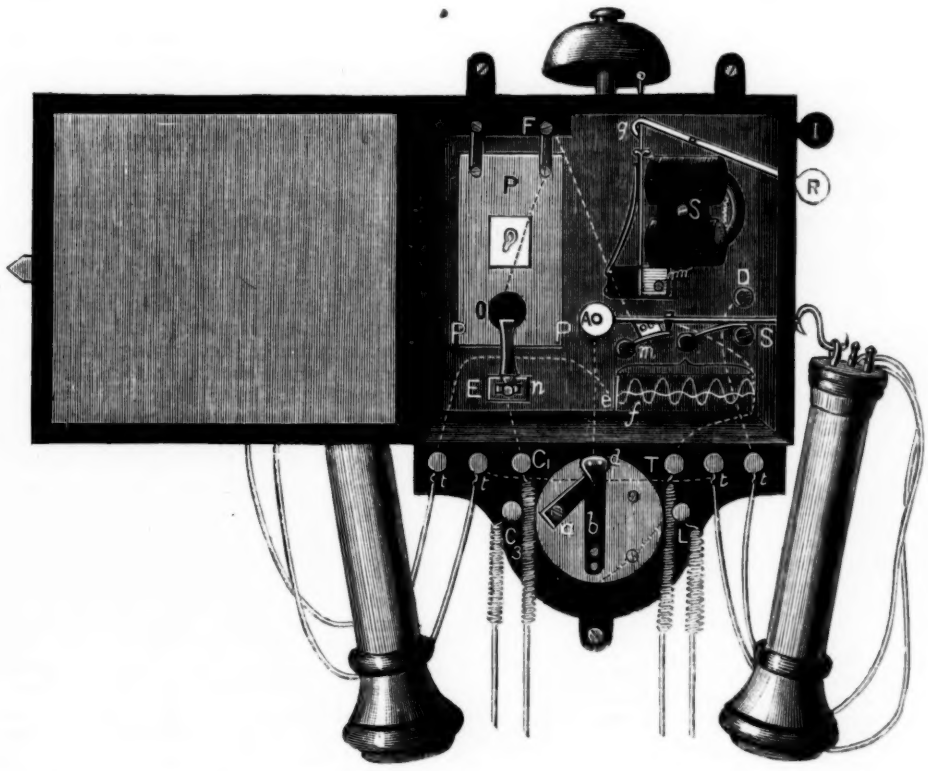
Electric Tramways in Ireland.—On Tuesday morning the first sod of the proposed electric tramway from Newry to Bessbrook was cut, the work being carried out by the Bessbrook Spinning Company. This will be the second electric tramway in Ireland.

M. DE LOCHT-LABYE'S "PANTELEPHONE."

THIS apparatus, which we, in our issue of August 25th, promised to describe, is not by any means new, as it formed one of the principal telephonic attractions at the Paris Exhibition of 1881, and it there achieved great success. It is said that persons speaking to this instrument might retire from it to a distance of 30 metres and yet the speech would be repeated at the receiving end. The instrument is sensitive to all kinds of sounds, loud or feeble, coming from long or short distances, and it is applicable to all kinds of telephonic receivers.

There is combined in the apparatus, shown fully in the drawing, the following parts: the pantelephone, the call button, *a*, *b*, *d*, the bell, S, the visual signal, *g*, R, I, the interrupting switch, A, actuated by the weight of the receiver, and the induction coil, *e*, *f*.

The pantelephone is arranged on the left side of the figure, and P, P, P is a cork plate suspended by two small flexible springs, F; the plate bears at its lower extremity a small flat disc of carbon, O, which is in



contact with a platinum stop fixed to the end of a metallic bar hinged at *n*

This kind of joint, it is stated, allows of increasing and decreasing the pressure of the two bodies, and insures perfect contact between the carbon and platinum. The opening of the door, closed in the normal condition of the apparatus, does not effect any derangement. It is not necessary to refer fully to the connecting up of the instrument, but we may mention the following points:—

The pressure of the finger upon the call-button in the first station breaks the connection of the spring, *b*, with the contact, *d*, and establishes it with the stop, *a*.

The current traverses in the first station, C_3, *a*, *b*, L, passes by the line wire to the second station in the apparatus of which it enters by the terminal, L, arrives at the commutator, A, and the commutator lever being in contact with the stop, S, the current passes into the bobbins of the bell-magnet, S, whence by the armature, its spring, and the return wire, it returns to the negative pole of the battery in the first station.

The circuit being closed, the call-bell in the second post is put in action. This disengages the lever, *g*, R, which uncovers the disc, I. If the correspondent is absent at the time of the call, this permanent signal informs him on his return that some one desires to correspond with him.

This description will enable our readers to understand the mechanism of the apparatus.

All the regulation consists in manipulating the joint at the thumbscrew, so as to produce close contact between the carbon plate and the platinum stop and modifying, by inclination of the plate, the pressure of the plate upon the stop. This regulation is not difficult, since there is a space of more than a centimetre between the extreme positions of the stop.

This is the transmitter which M. De Locht-Labye uses with his "Hammer" telephone.

THE NEW PATENT LAW.

MR. J. H. JOHNSON, solicitor and patent agent, sends us the following epitome of the effect of the new patent law which received the royal assent on the 25th ult.

The Act to amend and consolidate the law relating to patents for inventions, registration of designs and trade marks, will come into operation 1st January, 1884. It repeals wholly or in part no less than 23 statutes, and by simplification of procedure and reduction of fees effects great changes.

Although the Act provides for certain alterations in the existing laws of trade marks and designs, the following remarks are confined to the one subject of patents for inventions.

There has been no substantial alteration in the patent laws since the Act of 1852, although numerous bills have been introduced into Parliament by the various Governments and private members. The amendments now effected are, to a very considerable extent, those recommended by the committee of the House of Commons in 1871.

The main alterations effected as regards the law of patents are as follows:

The Government fees on application for provisional

protection are reduced from £5 to £1, and the Government fees for completing the patent for the first term (four years in place of three as at present) are reduced from £20 to £3, so that the patent will be granted for a term of four years for a sum of £4.

There is no alteration in the amount of the subsequent payments for the extension of patents from four to fourteen years, but in place of paying the £50 and £100 duties in lump sums at the end of the third and the seventh year, these sums are now payable at the option of the patentee, either in one sum of £50 at the end of the fourth year, and one sum of £100 at the end of the eighth year, or by annual payments of £10 before the end of the fourth, fifth, sixth, and seventh years; £15 before the end of the eighth and ninth years; and £20 before the end of the tenth, eleventh, twelfth and thirteenth years.

Patents will be granted to the inventor jointly with others, but the inventor must in every case make a declaration that he is the true and first inventor.

Applicants for patents may, if they so think fit, transact all their business with the Patent Office by post, and the various post offices throughout the country are to keep on sale the stamped papers required in applications for patents. Each application for a patent is to be confined to one invention only.

The procedure on application is as follows:

The inventor must lodge at the Patent Office a declaration and provisional specification. These documents in place of being referred to the law officers for examination, are to be referred to an examiner. This examiner's duties are to see that the provisional specification fairly describes the invention, and to see that the title of the invention sufficiently indicates the object of the invention. The examiner has also to report to the comptroller (the officer at the head of the Patent Office) whether the application conflicts with any other unsealed application in the office.

The provisional specification having been approved, the applicant must then prepare his final specification, and lodge it at the Patent Office within nine months from the date of application. This specification is again referred to an examiner who has to ascertain that the specification is properly prepared, and is consistent with the provisional specification. The examiner, in the cases of both provisional and complete specifications, is to report to the comptroller. If the applicant is dissatisfied with the decision in either case, he can appeal to the law officers. If the complete specification be not accepted within 12 months from the date of application, the application is to become void.

The patent is sealed after the final specification has been passed by the comptroller.

The provisional specification remains secret until the complete specification is filed, but after that both provisional and complete specifications are to be open to public inspection.

Specifications may be amended by way of disclaimer, correction, or explanation. The comptroller is to decide upon all applications of this nature, there being an appeal from his decision to the law officers. A very important provision is also introduced for the purpose of enabling the patentee to disclaim, by leave of the judge, during the progress of an action, and without stay of proceedings.

The Board of Trade has power to grant compulsory licenses in default of the patentee granting licenses on reasonable terms, and on proof that—

(*a*) The patent is not being worked in the United Kingdom;

(*b*) The reasonable requirements of the public are not supplied;

(*c*) Any person is prevented from working or using to the best advantage an invention of which he is possessed.

The jurisdiction of the Privy Council in cases of prolongations of patents is retained, but the almost obsolete power given to the Privy Council to confirm patents is not re-enacted.

The action of *scire facias* is abolished, but revocations of patents may be obtained on application to the Court.

The right of the Crown to the free use of patented inventions is abolished, but the Crown is to be at liberty to use patented inventions on terms to be settled by the Treasury.

In all legal proceedings with respect to patents the Court may, and at the request of either party shall, call in the aid of an assessor.

Letters patent may be granted to the personal representatives of deceased inventors.

The clause of the Patent Law Amendment Act, 1852, by which the British patent lapsed with the expiry of any foreign patent of anterior date, is not re-enacted.

The provisions as to the registration of documents at the Patent Office, the printing and publication of specifications, and the preparation of indexes and abridgements, are not substantially altered.

The comptroller is to issue an illustrated journal of patent inventions as well as reports of patent cases, and is to keep this journal and complete specifications of all patents in force, on sale.

Power is taken to join the International Union for the reciprocal protection of patents, and when this is done, the anterior publication of a foreign specification will not (for a limited time) affect the British application.

REVIEWS.

Electricity and its uses. By J. MUNRO. London: the Religious Tract Society, 56, Paternoster Row.

This work (of 180 pages) is a popular description of the principal applications of electrical power. Although the book contains well chosen matter, it possesses the defect of being carelessly and hastily written, the author, apparently, not having taken the trouble to correct his proof sheets, or to refer to his note-book when writing his descriptions. We come across several names of authorities spelt wrongly. On page 34 we have a drawing showing a land telegraph circuit, worked with Morse instruments, in which the connections are so arranged that the sender works his own receiving apparatus. Such an arrangement is not used in England. Speaking of the Wheatstone Automatic instrument the writer says: "The Morse inkwriter is well adapted for receiving messages sent by the automatic transmitter;" this is certainly news to us. In the chapter on "Electric power," a description of the Griscom motor is given. The writer here has apparently not taken the trouble to ascertain, or even to consider, whether his description (which is evidently copied direct from a prospectus) is a correct one, for we read the absurd statement: "The motor is peculiarly powerful, owing to the fact that the currents induced in the coils of the magnet by the rotation of the bobbin, with its magnet poles inside it, are caused to assist the magnetizing current supplied to the ring coils by the commutator, and thus heighten the magnetism of the ring poles." We could, unfortunately, give many more instances of the author's carelessness, though we forbear to do so, as the work is really one of considerable merit, indeed, in the hands of Mr. Munro it should hardly be otherwise. As we have said, the matter is judiciously chosen, whilst there are plenty of illustrations, and, as the author states in his preface, the volume is only intended to give the general reader some account of the recent advances in electrical subjects. As an attempt to popularise electrical science in all its branches the book may be to some extent recommended.

Obituary.—We have to announce, with regret, that Mr. Cromwell Fleetwood Varley, F.R.S., the eminent electrician, died unexpectedly at his residence, Cromwell House, Bexley Heath, on Sunday last. Mr. Varley was an exceedingly accomplished scientific man, and had patented or introduced many useful inventions.

ELECTRO-MOTORS AND THEIR GOVERNMENT.

By Professors W. E. AYRTON, F.R.S., and JOHN PERRY, M.E.

(*Continued from p.* 156.)

EFFECT OF LEAD ON THE BRUSHES ON SPARKING.

We have already explained that one cause for the sparking at the brushes arises from self-induction, but there will be another cause arising from an electromotive force existing in the coil short-circuited at a brush, if such a coil be cutting lines of force owing to the brush not being at a neutral part of the resultant field. Hence the importance of placing the brushes at the neutral part of the resultant field. In a dynamo a forward lead will do this, as shown from the following figure (No. 25), where S, N represents the magnetic

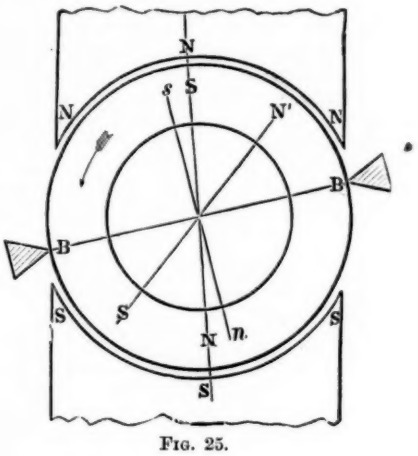


FIG. 25.

axis of the field in the armature, produced by the current flowing round the field-magnet, and modified by all the iron in the machine ; N′, S′ the magnetic axis of the field produced in the armature by the current flowing round the armature, and modified by all the

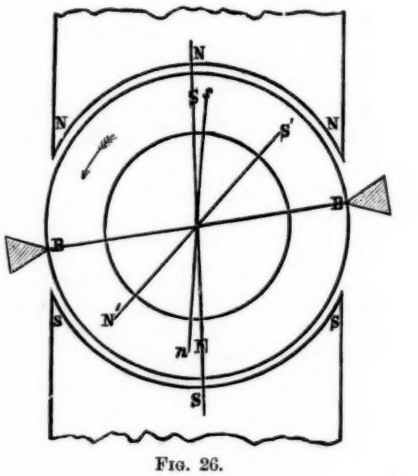


FIG. 26.

iron in the machine ; and *s*, *n* the axis of the resultant magnetic field, which is at right angles to B, B, the line of the brushes.

If the machine is a motor with a forward lead, then the polarity of N′, S′, due to the armature coils, must be reversed, and we have the arrangement shown in fig. 26. The axis of the resultant fields is now not perpendicular to the line of the brushes, and so there must be some sparking ; but the two are more perpendicular than in fig. 27, where the direction of rotation is reversed, and which would correspond with a dynamo having a backward lead. Consequently, while in a dynamo a back lead of the brushes, corresponding with the two fields strengthening one another, would be to some extent balanced by excessive sparking, this is not so much the case in a motor with a forward lead of the brushes, since the twist in the field, due to the rotation, assists the perpendicularity of magnetic axes in a motor while it diminishes it in a dynamo. And as a proof that putting the brushes with a backward lead in a motor, so as to prevent all

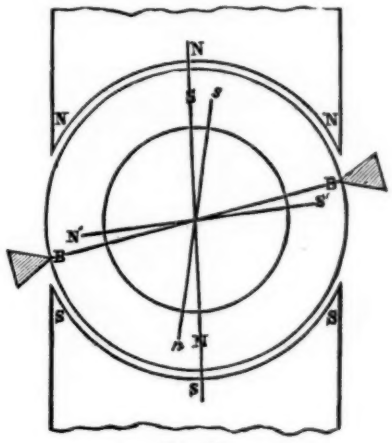


FIG. 27.

sparking, is really detrimental to the power and efficiency of the motor, we append the following results of experiments made by us on this subject, using a motor weighing thirty pounds, consisting of a Gramme ring rotating inside a Siemens field-magnet :—

Lead.	Remarks.	Revolutions per minute.	Current in ampères.	Potential difference at terminals in volts.	Load on dynamometer in lbs.	Horse-power given in.	Horse-power given out.	Efficiency per cent.
— 45°	Very little sparking at the brushes	3,162	11·2	35·6	1·1	0·535	0·116	21·6
0°	Much sparking at the brushes ..	3,045	9	41·2	„	0·469	0·111	23·3
— 20°	Less sparking at the brushes ..	3,130	10·1	42·5	„	0·576	0·115	19·9
0°	Much sparking at the brushes ..	3,248	8·2	42·7	„	0·468	0·119	25·4
— 20°	Less sparking at the brushes ..	3,405	9·4	42·7	„	0·558	0·124	22·1
0°	Sparking partly due to the brushes requiring trimming	3,147	9·0	42·9	„	0·519	0·115	22·2
	As the brushes were observed to be not making as good contact as possible with the commutator, they were here taken off and trimmed, and the experiments repeated.							
— 30°	Little sparking at the brushes ..	3,228	9·7	42·5	„	0·578	0·118	20·4
0°	Much more sparking at the brushes	3,181	8·2	42·5	„	0·469	0·116	24·8

A negative lead means a lead in the direction of the lead ordinarily given to the brushes in a motor, or against the direction of rotation.

From an examination of the potential difference at the terminals with the current sent through the motor in each case, it will be seen that for a lead of 0° there is the highest back electromotive force. Further, from an examination of the table of efficiencies it is seen that a lead of 0° gives a higher efficiency than a negative lead.

It has already been pointed out that the condition of non-sparking at the brushes, apart from self-induction, is the same as the condition that the number of lines of force cutting a coil should not alter as the coil passes a brush ; and, referring to fig. 18, we see that this is the same as saying that the brush should be at the top of a crest or at the bottom of a wave in the curve for the resultant number of lines of force cutting a coil. In the case of the curve, D, corresponding with a dynamo with a forward lead, we see that this condition is fulfilled with considerable accuracy, and also that it is approximately fulfilled in the case of the curve, M, corresponding with a motor with a forward lead.

In fig. 27 we have already seen roughly what would happen if we employed a backward lead in a dynamo.

Let us now, with the aid of the curves shown in fig. 19, consider how far the employment of the sum of the strengths of the fields due respectively to the armature and field-magnet, instead of the difference, which is all that is ordinarily made use of, would be beneficial. Let us take $\phi + \gamma$ equal to $-22°\frac{1}{2}$, and ϕ to about $-35°$: that is to say, let there be a back lead of 35°. The number of lines of force then cutting a coil at a brush, due to the armature field as affected by the rotation, as well as by the distorting action of the field-magnet, will be represented by something like J, K in fig. 19, corresponding with an angular distance of $-35°$ in the curve corresponding with $\phi + \gamma$ equal to $22\frac{1}{2}°$. Now J, K is very small, and, further, the number of lines of force due to the field-magnet cutting the coil when at a brush at $-35°$, corresponding with J, K, fig. 18, is also much smaller than its value, B, K, at the brush when it has a forward lead. Hence the sum of these two sets of lines of force for a back lead may not be so large, compared with the corresponding differences when the brush has a forward lead, as to counterbalance the injurious effect of sparking.

Determination of the Power and Efficiency of Motor-Absorption Dynamometers.

The power in Watts given to a motor, or indeed to any circuit to which electric energy is being supplied, is equal to the current, C, in ampères passing through the circuit multiplied into the potential difference, V, in volts at the terminals. A portion, C^2, R, of the power so furnished to the motor is wasted in heating the motor, due partly to the statical resistance of the motor, R_0, or resistance of the motor at rest, and partly to the increase in the resistance, n, p, already referred to, and which is produced by self-induction. The remainder of C, V, which is equal to C, v, where v is the back electromotive force in volts produced by the motion, is converted immediately into mechanical energy of rotation, but not necessarily into useful energy, since a portion of the power the motor produces is spent in overcoming the mechanical friction at the bearings and the mechanical friction of the brushes rubbing on the commutator, while another portion is spent in overcoming air friction and what may be called magnetic friction—that is, the resistance arising from the generation of Foucault currents in all pieces of metal, the number of lines of force cutting which is alternately increased and diminished as the movable part of the motor rotates; and it is only a third portion of the power the motor develops which is usefully given out, this latter, in Watts, being equal to the torque, T, multiplied by n, the number of revolutions per minute, where T therefore stands for the moment of the twisting couple exerted by the moment in pound feet divided by 44·25.

The following table shows graphically the way in which the power supplied to a motor is used up:—

- C, V
  - C^2, R
    1. C^2, R_0.
    2. C^2, n, p.
  - C, V
    3. Power spent in overcoming the friction at the bearings and the friction of the brushes against the commutator.
  - C, v
    4. Power spent in overcoming magnetic friction arising from the creation of Foucault currents and in overcoming the friction of the air.
    5. Power usefully given out by the motor and equal to T, n.

The real power of the motor is simply of course T, n, and the efficiency only $\frac{T\,n}{C\,V}$. In theoretical calculations not unfrequently 4 is totally neglected; indeed, in the published calculation of the efficiency of a well-known motor that recently was brought to our notice, 2, 3, and 4 were neglected, and the efficiency was said to be 90 per cent. Indeed, C^2, n, p is almost invariably neglected, so that only C^2, R_0 is assumed to be the waste of energy from heating, whereas it must necessarily be C^2 $(R_0 + n\,p)$, even if all masses of metal in which Foucault currents might be generated were so electrically subdivided as to diminish the generation of such currents to a very small amount.

To measure, then, the power and efficiency of a motor, the important things to observe are C, V, T, and n, T may be measured with some form of absorption dynamometer, of which we have found the compensating forms devised by Professor James Thomson, by M. Carpentier, and by M. Raffard very convenient, while the older Prony brake can be made to give fairly good results for a short time if a constant stream of water be allowed to flow over it.

In making experiments on motors, it is very important to be able to keep the torque constant while changes are made in the speed, in order, for example, to see exactly how for a constant torque the current varies with the speed. With the simplest form of absorption dynamometer, consisting of a cord or band passing over a pulley, and having unequal weights attached to its extremities, this is almost impossible, since, in order to keep the difference of the weights constant, it is necessary, if the co-efficient of friction between the cord and the pulley alters, to alter the smaller weight, and hence also the larger. This is easily seen from the equation

$$P - Q = Q\left(2{\cdot}71828^{\,k\frac{l}{r}} - 1\right)$$

where P and Q are the two weights, k the co-efficient of friction, l the length of the cord wrapped on the pulley, of which the radius is r. Now, as even with careful lubrication it is difficult to keep k, the co-efficient of friction, perfectly constant, and as also it is difficult to arrange to increase or diminish both weights as the co-efficient alters, it follows that the simple dynamo-meter cannot be employed, as the cord is constantly tending to slip off on one side or the other of the pulley. If a spring balance be attached to the cord on the side on which the tension is greatest, the arrangement becomes automatically adjusting, but it does so by P varying to suit k, hence P — Q is not a constant. The Prony brake is to a certain extent an improvement on this, because alterations in the co-efficient of friction can to a certain extent be compensated for by tightening up the screws of the brake-block by hand, without altering the weights attached to the end of the lever. The compensating dynamometers referred to above are, however, better still, since with these the length of band wrapped round the pulley is automatically adjusted as the co-efficient of friction alters. And further, the torque, which is proportional to P — Q can be increased simply by increasing P, and without altering Q, since here again l automatically changes to suit this change.

In spite, however, of these advantages, there are certain disadvantages attending the use of such a compensating dynamometer, arising from the fact that it is quite a distinct instrument from the motor, and has to be carefully coupled to the shaft of the motor, considerable precaution being necessary, even when a flexible coupling is employed, to avoid friction being introduced by a strain on the two shafts.

We have therefore set ourselves to devise some simpler form of compensating absorption dynamometer, and have arrived at excellent results by using a most simple expedient. In the Prony brake the amount of pressure between the brake and the pulley is adjusted by screwing up the tightening screws by hand, to compensate for changes in the co-efficient of friction: in the Thomson, Carpentier, and Raffard dynamometer it is the length of the band wrapped round the pulley that is automatically altered; but the plan we adopt consists in keeping the length of the cord fixed, but automatically varying the nature of the cord in contact with the pulley. Fig. 28 shows the exact

arrangement we employ. On the shaft of any motor of which the power and efficiency are to be tested, is keyed a grooved wheel of suitable diameter, and in the grove of this wheel is placed a cord carrying two unequal weights at its ends in the ordinary way. The two halves of the cord are of very unequal thicknesses and co-efficients of friction, the junction between the two portions being slightly tapered. The thicker and rougher part of the cord carries the smaller weight, and is therefore on the descending part of the wheel, and the compensating action, which we find to be very perfect, it is very easy to understand. If from the drying up of the lubricant, or from any other cause, the co-efficient of friction between the grooved wheel and the cord becomes greater, the larger weight is raised, and were there no adjusting arrangement it would be thrown over the wheel. But the ascending of this larger weight causes less of the rougher, and more of the smoother cord to be wrapped on the wheel. Hence the larger weight rises only far enough for this change to be effected to a sufficient degree to compensate for the increase in the co-efficient of friction. And if the co-efficient of friction diminishes, it is the larger weight which descends a certain amount, causing more of the rougher, and less of the smoother cord to be wrapped on. It is obvious that, by using a grooved

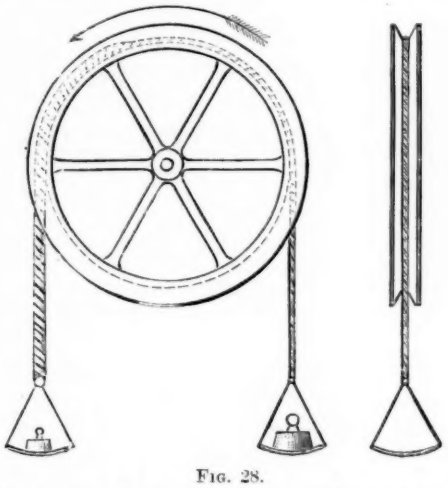


FIG. 28.

AYRTON AND PERRY'S COMPENSATING DYNAMOMETER.

wheel of sufficiently large diameter, the sum of the weights, and consequently the pressure of the motor shaft on its bearings, corresponding with any given torque, can be made as small as we like.

It was not until near the completion of this investigation in motors that we devised the new form of compensating absorption just described; hence the majority of our experiments have been made with a Raffard dynamometer. We have already explained the importance of using a flexible coupling between the shaft of this dynamometer and the motor shaft; and in the case of small motors, where the useful torque is necessarily small, the utmost care must be taken to avoid the introduction of even a small unknown resistance at this coupling, if the maximum power of the motor is to be obtained. With such small motors, we have found that a long spiral spring, with coils of comparatively small diameter, formed a very good flexible coupling.

And the same kind of spiral spring coupling we have used to connect the speed counter, or the speed indicator, with the motor, since the ordinary plan of pressing by means of the hand the speed counter or indicator against the revolving spindle of the motor is quite inadmissible when testing small motors, as the variable hand-pressure introduces a serious unknown error into the results. A speed indicator which gives the speed at any moment is the more convenient, but its calibration must not be forgotten to be made, by comparing its readings at different speeds with the results obtained with a speed counter, seeing that the majority of the speed indicators we have met with have had quite appreciable errors in the graduation. We have found it, however, quite easy to obtain very consistent readings by using a speed counter turning constantly with the motor: for although the counter is continually revolving, we find it possible, at a speed of 2,000 revolutions a minute, not to make an error of more than six or seven revolutions, or only about $\frac{3}{4}$ per cent., by observing it when in motion at the beginning and end of a certain interval of time.

(*To be continued.*)

THE ELECTRIC LIGHT ON BOARD H.M. INDIAN TROOPSHIP "MALABAR."

THE Admiralty has shown in this large and beautiful ship, which has been lighted throughout, a recognition of the value and advantage of the electric light for internal as well as external use in ships of the Royal Navy. For such vessels as the *Malabar*, which are constantly employed in conveying large bodies of troops to and from India, a well-considered system of electric lighting possesses special advantages that cannot be estimated too highly. In addition to the comfort and

FIG. 1.

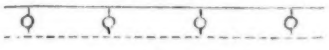
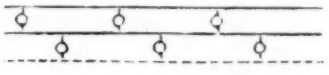


FIG. 2.



convenience to all on board, we think, where properly applied, that the electric light affords greater security from fire than any other system of artificial lighting. From the subjoined particulars, which we are enabled to lay before our readers, it will be seen that the Admiralty not only recognises this fact, but, in the case of the *Malabar*, such necessary arrangements have been made as to reduce fire risks to a minimum. Fortunately destructive fires in Her Majesty's navy have not been numerous, owing no doubt to the discipline and regulations in force in these ships, but when they have occurred they almost invariably originated in the use of portable lights, which the elaborate construction of the ships necessitated to a large extent. It will be remembered that this was the origin of the *Doterel* disaster, which, in its consequences, was probably the worst which has ever happened at sea to a vessel quietly riding at anchor. The *Malabar* is so thoroughly supplied with electric lamps as to render portable lights unnecessary by day or by night in any part of the ship, thus removing this most prolific source of danger. Again, the danger from the system itself has, as will be seen, been guarded against in such a manner as to make it almost impossible for such a contingency to arise from this source. These are simple but important matters of detail, which severe critics of cost of such work should not fail to note. To minimise the risk to human life and such valuable ships, are higher considerations than any money cost involved in securing them. The mere convenience of the abundant light in this ship we are sure will be appreciated by all who travel in her; the main saloon especially is an example of efficient and tasteful lighting, and highly creditable to those responsible for it; but we think that the greatest boon of all is conferred on the occupants of the mess decks. Here every table has its lamp at its head—an arrangement, we are informed, which was initiated by Admiral Sir W. Mends, formerly at the head of this branch of the public service. The distribution of the current in the *Malabar* is made by 15 distinct circuits, each lighting a section of the ship. There are over 7,000 yards of thoroughly insulated wire laid in sunk grooves in solid teak, and each of the distinct circuits originate in the main switch board in the

dynamo room, and are solely controlled by the artificer in charge—an arrangement which has the advantage of enabling him to properly govern the speed of the dynamo according to the work it is required to do. The main switch board, which thus forms the controlling centre in itself, is shown by fig. 6, and was designed, we believe, by Mr. Lane, electrician of the Dockyard, and it possesses novel features worthy of notice. The base of the switch board is slate; on the right it will be seen the dynamos are connected to four vertical bars on its back; in front, is a circular plate with two radial slots moving through 90°. The dynamos are plugged to the various circuits through these slots, which with the motion on its centre admits either dynamo being put on to any or all the circuits, and prevents both dynamos being at one and the same time

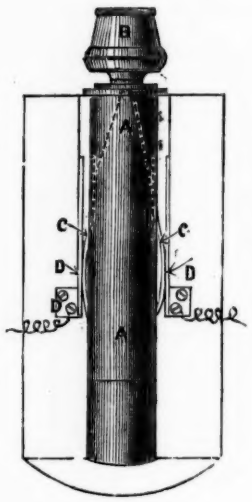


FIG. 3.

FIG. 4.

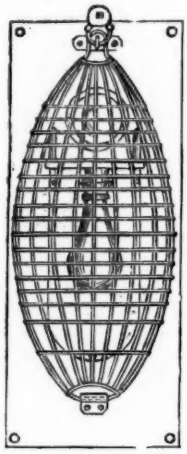


FIG. 5

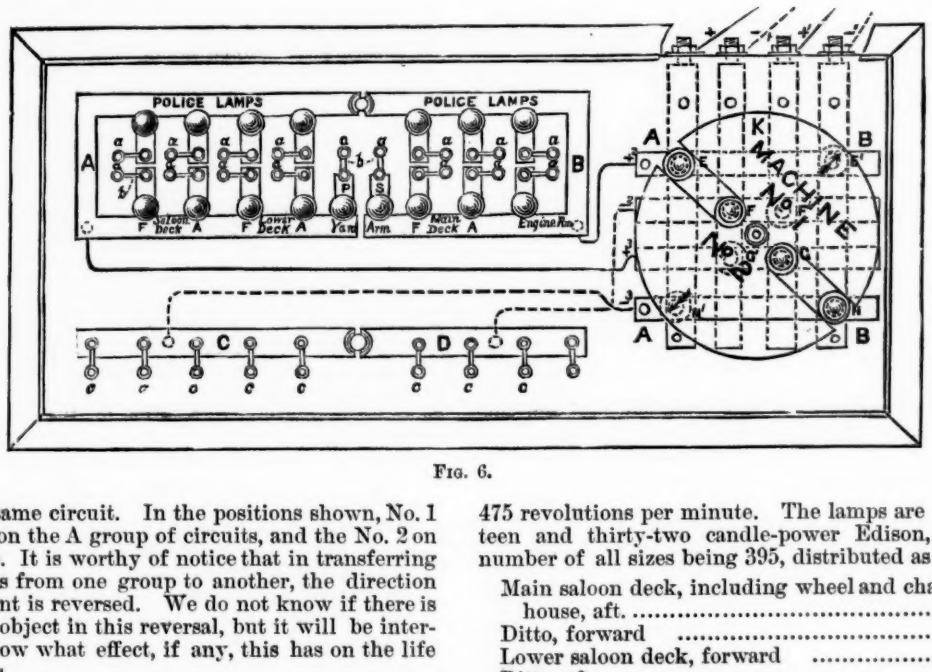


FIG. 6.

taken against any undue heating from excess of current through inattention to the speed of the machine. When a large number of circuits are idle, the current to each distinct circuit passes through a fusible plug (c, c) on the lower part of the board, an arrangement which shows that its designer was not only alive to the importance of such precautions, but also possessed the means of making them certain and effective. Every part of this extensive installation shows praiseworthy care in all its details. The + and — wires are all laid in separate grooves in very substantial teak casings. On mess and troop decks they are guarded from possible injury from nails driven into wood fronts by a plate of iron covering the front.

The dynamos are the improved low speed Edison L type driven by Brotherhood engines at a speed of 475 revolutions per minute. The lamps are eight, sixteen and thirty-two candle-power Edison, the total number of all sizes being 395, distributed as under:—

Main saloon deck, including wheel and chart-house, aft.	54
Ditto, forward	30
Lower saloon deck, forward	34
Ditto, aft.	25
Main deck (forward) and store-room	86
Ditto, aft.	28
Engine, boiler and store-rooms connected	47
Police circuits, all decks	75
Yard-arm lanterns, 2, each having 8 32-candle-power lamps	16
Total	395

Every precaution which forethought could suggest

put on the same circuit. In the positions shown, No. 1 machine is on the A group of circuits, and the No. 2 on the B group. It is worthy of notice that in transferring the dynamos from one group to another, the direction of the current is reversed. We do not know if there is any special object in this reversal, but it will be interesting to know what effect, if any, this has on the life of the lamps.

Another feature of the arrangement is, that in the event of one dynamo being put on both the A and B groups, as will always be the case when working the day and night circuits only, the idle machine plugs are required to connect the two groups, thus effectually preventing any part of the current from running through the idle machine. Each lamp in the ship has its own safety plug, the wire leads are of ample capacity for the currents they take, and a farther precaution is

has been taken to guard against failure of the light, and for minimising the period of failure should it happen from any unforeseen cause. To fully light the ship throughout, at one time both machines are required, but as the extensive police circuits are never required when the mess and troop decks are fully lighted, and the yard-arm lights only occasionally when coaling or taking in or putting out baggage at night, one machine can fairly light the ship in the event of a break down of the other, and a spare armature, which is the only part of the dynamo liable to get out of order, is provided. These precautions minimise the risk of failure, in addition to which, the ordinary appliances are carried for lighting and can readily and quickly be brought into use. The lamps in the pilasters of main saloon, the only ones mounted in candle lanterns, connect automatically, and can be removed and replaced as readily as the ordinary candle lamp (see fig. 3). Besides these, there are in this saloon twenty-four full lamps mounted in egg-shaped globes connected to ornamental pendants by bayonet joints (as shown in fig. 4). Fig. 5 shows a wire guarded lamp. The official trial of the installation on completion by the Edison Company was made in the presence of Mr. Farquharson, Admiralty electrician, the officers of the yard, and representatives of the company. A day run of six hours and a night run of two hours were made without stopping or hitch of any kind, and afterwards a still more crucial test of the power of each machine was made, and correct measurements of current and light at various speeds, exceeding the normal, to ascertain for future guidance the extra work that could safely be put on one set of dynamos and engines. The results are shown in the table below, and were considered quite satisfactory. On Monday the whole was inspected by Rear-Admiral Herbert, superintendent of the yard. The yard-arm lights were tested as to their efficiency for night work, and the dynamos transferred to the various groups. Everything worked well and smoothly, and the Admiral expressed his satisfaction with the arrangements and the highly creditable manner in which the contractors have carried out their work :—

ONE MACHINE WITH ALL LAMPS IN CIRCUIT.

Revs.	Ampères.	E. M. F.	Candles per Lamp.	
540	160·5	79·68	6·2	
527	138·	87·15	10·7	With Police Circuits out.

The thirty-two and sixteen candle-power lamps are placed in multiple circuits (see fig. 1) between the main and return wires. The eight candle-power lamps, requiring only half the E. M. F. of the sixteen candle type, are placed in multiple circuit, two in series, an idle wire being run between the main and return wires (see fig. 2). These lamps are connected alternately from main to idle wire and from idle wire to return to prevent inconvenience from the failure of one.

NOTES.

Electric Lighting.—We publish this week an article on the distribution of The Edison lamps on board H.M.S. *Malabar*. The generating plant on board this vessel consists of two Edison L or 150-light dynamos driven by two direct-acting Brotherhood engines. The various tests which have been made by the Admiralty officials have proved eminently satisfactory, and the manner in which the details of the work have been carried out by the Edison Company has been the subject of favourable comment on the part of the officials, the very effective lighting of the saloon being especially commended.

The Edison Electric Light Company has received a further order from the Admiralty for the fitting up of the electric light on board the Indian troopships *Serapis* and *Crocodile*. About 400 lamps will be employed in each vessel, partly of eight and partly of sixteen candles. The generating machinery will be duplicated to avoid risk of a breakdown. The dynamos will be of the Edison special slow speed type for marine use.

During the annual show of the Dundee Horticultural Society at Dundee last week, the Northern Electric Light Company electrically lighted the halls and Parker Square, with excellent effect.

The Electric Lighting Act.—A Parliamentary paper has been issued containing the report of the Board of Trade respecting the applications to and proceedings of the Board under the Electric Lighting Act of 1882. From this statement it appears that by the 21st of December last, the date prescribed by the rules which the Board of Trade had issued, 106 applications had been received. Twenty-three of these were promoted by local authorities, and 83 by companies; 97 of the applications related to places in England and Wales, eight to places in Scotland, and one to Belfast, Ireland; 35 related to London and the suburbs. A list of the applications is given in an appendix. A fee of £50 was received with each application, and in ten cases where separate orders have been granted for various districts included in one application, an additional fee of £10 has been charged by the Board of Trade. The total amount of fees received amounts to £5,400. The time for lodging objections was limited by the rules to two months from the date of the first advertisement of the application. It was, however, extended by a new rule to the 1st of February. Eventually, after a consideration of the orders as deposited, and of the objections which had been lodged against them, the Board of Trade determined upon the principles upon which the applications should be dealt with, and on the 28th February they circulated model clauses for adoption with such modifications as might appear to be necessary. The charges to the public are more than covered by the fees received. The report is supplemented by several appendices.

The Glasgow Postal Telegraphs Instrument Room.—Messrs. Wm. Chambers & Co., photographers, Buchanan Street, Glasgow, have finished an admirable photograph of the interior of the instrument-room in the telegraphic department of the General Post Office. The photograph is a fine specimen of the advance which has of late years been made in the photographic art, and presents a notable example of the progress which has enabled the photographer to surmount what formerly were regarded as impassable restraints. The room devoted to the instrument work in the telegraphic department is 180 feet long, and when it is stated that not merely the details of the vast room, but the countenances of upwards of 200 operators at work are presented with perfect accuracy, the photograph must be acknowledged to be of great excellence. In addition to the operators there are included in the photograph several of the higher officials, among whom are Mr. Hobson, the postmaster, and Mr. Midgley, superintendent-in-chief of that important department.

Destruction of telegraph plant.—A Penzance correspondent, telegraphing on Sunday evening in regard to the storm, states that the fury of the wind may be imagined when it is stated that it tore up numbers of the telegraph poles along the Eastern Telegraph Company's line.

Hanoi (Tonquin), and Saigon Telegraph.—We understand that in the treaty lately signed between the French Government and Tu-Duc, Emperor of the Annamites, it has been stipulated that the Government of Annam guarantees the maintenance of a land line which the French Government proposes to erect between Hanoi (Tonquin), and Saigon, Cochin China. A station will be opened at Hué. On account of the length of this line (about 1,000 miles), and the country

it will run through, the undertaking is one of no ordinary magnitude, and there is no doubt that during the construction the French Government engineers will meet with many difficulties, both mechanical and political.

The West India and Panama Telegraph Company.—Some interesting correspondence has recently appeared in the *Money Market Review* anent the prospects of the above company. Two letters by Mr. John Harold, of the new Athenæum Club, especially are worth reading, and as we cannot find space for the epistles *in extenso*, we will endeavour to give the gist thereof in as few words as is possible. Mr. Harold appears to have been one of the owners of the concessions for the West Coast of America cables, and in March, 1881, was in treaty with Mr. Shuter, of the Telegraph Construction and Maintenance Company, for the sale of the said concessions, and their extensions to the company. Mr. Shuter, on behalf of his directors, declined the business, but afterwards, "in hot haste," entered into a contract to give £21,500 for the concessions, and cabled £1,500 of the sum to New York. In fact, he (Mr. Harold) alleges that whilst Mr. Shuter was trying to put him off the scent, he was himself, as he afterwards discovered, being befooled by Mr. Scrymser, who, whilst leading him to suppose he was to have the contract to manufacture and lay the cable, was quietly negotiating with the India Rubber and Gutta Percha Company. Mr. Harold sums up the outcome, so far, of the matter in these words :—

"The Telegraph Construction and Maintenance Company will probably lose its £1,500, to say nothing of the profit it would have made in making and laying the cable. The West India and Panama Company have now to face a powerful opponent, the result being seen in the miserable condition of its property, which will become worse and worse. The same remarks apply to the East Coast and Brazilian Companies, who, I learn, have resolved upon a large reduction of their rates to meet the competition of the West Coast Companies. But for Mr. Shuter's delicate *finesse*, and wire-drawn diplomacy, the chain of telegraphic communication, from London to London by the Brazilian, East and West Coasts of South America, and the West India and Panama—all English companies—would have been perfect. Now the chain is broken, and an intermediate link held by a foreign and powerful company, backed by all the strength of the most powerful telegraphic organisation in the world—the Western Union."

In another letter he says :—

"Now, what I would ask you the favour to allow me to suggest is this, viz. :—That a few of the principal shareholders in the companies whose properties are injured by this opposition meet me. I will cheerfully place the situation before them. The concessions under which the West Coast cable has been laid are either the property of the company which has laid them or they are not. If, as we contend and claim to prove, they are not, then the company which has laid them will have (1) to surrender the cables, or (2) pay heavy damages, or (3) enter into equitable pro-rating arrangements with the English companies. I believe that something may be evolved out of all this which will save our properties. In any case no harm, I apprehend, can arise from an unofficial discussion of the situation, without (in the first instance) the intervention of boards or their legal representatives. In suggesting this mode, I of course have no idea of reflecting on the functions of those useful bodies."

With reference to the above, we may state that the West Coast of America cables referred to, are those connecting Lima, Peru, with Vera Cruz, Mexico, the system being composed of cables and land-lines touching at Payta, Peru; Santa Elena and Guayaquil, Ecuador; Buenaventura and Panama, U. S. of Columbia; San Juan del Sur, Nicaragua; La Libertad, Salvador; Tehuantepec and Goatzacoalcos, Mexico. At Vera Cruz communication is held through the Mexican Telegraph Company's lines with Galveston, Texas, U. S. of America.

As pointed out by Mr. Harold, we understand that the owners of the various lines connecting Buenos Ayres, Valparaiso and Lima are closely allied with the American companies, possessing the lines from Lima to Galveston. The Mr. Scrymser referred to, is president of the Central and South America Telegraph Company and also of the Mexican Telegraph Company, so that practically the communication from Lima to the States is in the hands of one man, who, without doubt, follows an exclusive policy so far as the traffic is concerned which might pass through the lines of the West India and Panama Telegraph Company from Panama.

The Western and Brazilian and the Brazilian Submarine, with their allied companies, are, no doubt, strongly interested in saving their Buenos Ayres traffic, as according to a note which appeared in our last, a bitter cutting of rates has ensued, and we notice that the tariff for messages to Buenos Ayres, *vid* Galveston, has been reduced to ten shillings per word, and, from appearances, this is not the last reduction which may be made.

Monetary Transactions by Telegraph.—The increasing popularity of the telegraph as a medium of monetary transactions, says the *Postal, Telegraphic, and Telephonic Gazette*, is a noteworthy fact. The rapid circulation of funds between the chief business centres of the world by means of what are known as "telegraphic transfers" affords facilities for the prompt turnover of capital which were unknown to a former generation. It is impossible to form any reliable estimate of the millions which pass over the cables of the world annually "in a liquid state," as the old postman said. But some idea may be formed of the magnitude of these telegraphic operations by the knowledge of one particular case. Each week our Government draws upon the Government of India for a certain portion of the funds to be annually transmitted thence to England. The record of the present financial year, commencing from April 1, shows that to date £6,558,756 has been drawn upon India, of which probably one-third to one-half has passed by means of the wires.

The Proposed New Atlantic Cables.—A London correspondent writes to a daily contemporary that the promoters of the new Atlantic Cables have a much more ambitious scheme in hand than is generally supposed. Not content with laying two cables to America, Mr. Alderman Hadley and his American friends, Mr. Mackay (the Bonanza King), Mr. Coe, and others, intend practically to take the whole world under their care. They will first lay two main Atlantic cables—one from Penzance to Sable Island, connecting Halifax, and thence to New York direct, and another from a point north of Glasgow to Belleisle, thence taking in the system of telegraphs to connect the West India Islands. On the American continent they have formed an alliance with the recently-founded Postal Union Telegraph Company, which intends to lay wires to all the chief cities and towns in the States. Having laid their Atlantic cables, the company intends next to turn its attention to the Pacific, under which cables will be laid to Japan, China, thence to Australia, India, the Cape of Good Hope, &c. Meantime, it is said £1,000,000 of the £1,500,000 required for the Atlantic part of the scheme has already been subscribed without an appeal to the public. The prospectus, which will shortly be issued, will give a glowing account of the profits of the Atlantic part of the scheme which will first be launched. It is calculated that 25 per cent. may be realised, and there will, it is thought, be little difficulty in raising all the money required. According to the present arrangement, the shore ends of the Atlantic cables will be laid this year, but the main cables will not be laid till next year.

The Gramme Patent Suit.—The final hearing of the suit in equity for infringement of the Gramme patent, which took place last month at Newport, R. I., has created, according to the New York *Electrical World*, a ripple of sensation and of excitement in the electrical community which is scarcely less interesting than that by which the recent decision in the telephone interference case was attended. The final arguments have been made, and in due time the decision of the learned judge will be forthcoming. While the decision is pending, however, the anxiety in certain quarters will necessarily be intense, and many of the small concerns now struggling into existence will seriously consider the question whether it is "to be or not to be"

with them. If the decision is in favour of the Gramme Company, the situation will become interesting in the extreme. It is claimed by the Gramme Company that every practical dynamo electric machine in operation in America infringes more or less the Gramme patent. Hence, in the event of a decision in its favour, we may expect a series of injunctions to be sown broadcast upon the "unorthodox" electric light companies. It is true that the Gramme patent will expire by limitation in about two years, but even in that short time much can be done to the detriment of the lesser interests. The case is of special interest to electricians and students from the fact that it bears on a warm controversy which has been waging within the last few years, about the priority of invention of the very subject of contention itself—namely, the dynamo-electric machine which forms the type of all our present forms. In the year 1864 an Italian scientific periodical, *Il Nuovo Cimento*, published a detailed and illustrated account of an "electro-magnetic machine," invented by one Doctor Antonio Pacinotti, Professor of Physics at the University of Pisa, which machine is constructed on the same general principle, and contains the same essential elements as the Gramme machine. The Arnoux and Hochhausen Electric Company, the defendant, did not rely altogether on the Pacinotti machine in their endeavours to prove the nullity of the Gramme patent. They contend further that this patent was void *ab initio* in consequence of not stating on its face the existence of the Austrian patent on the same machine. It is further claimed that the Austrian patent has expired, and that the American patent is, *ipso facto*, void. But the question involves certain points of legal formalities, and of the precedents of Austrian legal decisions, on which the judge will have to decide. In a case where so many experts disagree, it will doubtless prove difficult even for a judge to decide.

The London and Provincial Electric Lighting and Power Generating Company, Limited.—In our last issue we published the report of the directors of this Company, and also a rather full account of what took place at the *first* annual general meeting. Our representative had considerable trouble to obtain a copy of the report, and having been enabled to consider the said document since our last issue, we are not surprised. It will be unnecessary to go over the details of the accounts, which probably many of our readers have seen for themselves; but we would just call to their remembrance the statements published on pp. 342, 345 in our number of May 13, 1882, respecting the above company, at the time the company's prospectus was before the public. Also in the same number we published, on p. 343, an article dealing generally with the subject of electric light companies and their prospectuses. All that was predicted then has but too surely come about. The position of the company is most lamentable; but it would be well to remind the deluded shareholders of the result of a trial before the late Sir John Jervis, in which a shareholder successfully sought to get his money back. The learned judge said: "If the directors of a company seek to raise a large sum of money, and on the faith of such capital being subscribed, a contributor pays his money, he has a right, on only a small sum being raised and no limitation in the prospectus, to plead a breach of contract, and say, 'give me back my money'"; and the judge added, "this is the law of law books." The prospectus advertised £125,000 as the amount of the first issue, but the directors allotted on a subscribed capital of £29,065. In conclusion, we may say that this is one of those cases in which we should rejoice to see shareholders combining to prove, to their directors, that when they (the latter) consented to accept their positions, they also undertook, ostensibly, to act faithfully and honourably.

Telephony in New Zealand.—The following numbers of subscribers to telephone exchanges in New Zealand, which date about three months ago, may possibly be of interest to our readers:—Dunedin, 230; Auckland, 150; Christchurch, 120; Wellington, 60.

Telephonic.—It is stated that the prospect of now forming a local telephone company in Aberdeen is very good, the amount of promised support being exceedingly encouraging.

The Dundee Plans and Works Committee at their meeting on Monday, gave permission to the two telephone companies serving Dundee, to erect 24 new lines.

The price of Bell Telephone Stock.—The public, it would seem, says the New York *Electrical World* of the 18th ult., have already begun to look at the telephone situation and its probable effect on stocks pretty much as we explained it in last issue. In that number we chronicled the fall that had just taken place in telephone shares, especially American Bell. We learn, however, from the Boston papers, that Bell telephone stock rose almost as sharply on Thursday of last week as it declined on Wednesday, starting at 225 and rising to 240 without a check. The heavy drop of the preceding week brought in buyers. The Bostonians argue in this way. The People's Company may become formidable in time, but unless the lawyers and money give out, the Bell is liable to have the full benefit of its 17-year patent before the courts are through with the points in dispute. It is a great misfortune for Mr. Drawbaugh that the genius of the inventor and wealth of the capitalist were so slow in finding each other out, always supposing that the priority of invention rests with him, as is claimed by the People's Company.

The Magnetophone, or the Modification of the Magnetic Field by the Rotation of a Perforated Metallic Disc.—The following interesting note by Prof. H. S. Carhart, of Evanston, Ill., appears in *Science* of the 24th ult.:—"The experiments of Bell, Preece, and others, on the radiaphone, suggested the possibility of interrupting, or at least periodically modifying, the lines of force proceeding from the poles of a magnet, by means of a disc of sheet-iron, perforated with a series of equidistant holes, and rotated so that the holes should pass directly in front of the magnetic pole. It is well known that the armature placed on the poles of a permanent magnet diminishes the strength of the external field of force by furnishing superior facilities for the formation of polarised chains of particles from pole to pole. This is the case even when the armature does not touch the poles, but is in close proximity to them. If a piece of sheet-iron be placed over the poles of a magnet without touching, and magnetic curves be developed on paper above the iron, they will be found to exhibit less intense and less sharply defined magnetic action than when the sheet-iron is removed. If, however, a small hole be drilled directly over each magnetic pole, the screening action of the sheet-iron is modified in much the same way as when a hole is made in a screen opaque to light, for the developed curves show distinctly the outline of the holes. If, therefore, the sheet-iron in the form of a circular plate, pierced with a number of holes, be rapidly rotated between the poles of a magnet and small induction bobbins, the action of the magnet on the core of the bobbins will be periodically modified, because of the passing holes, and hence induced currents will flow through a circuit including the bobbin. A disc of sheet-iron was pierced with two circles of $\frac{1}{4}$-inch holes concentric with the disc, the number of holes in the two circles being 32 and 64 respectively. On one side of the disc was placed a horseshoe-magnet, with its poles very near the rows of holes; on the other side were arranged two corresponding induction bobbins. The circuit was completed through a telephone and either bobbin at pleasure. Upon rotating the disc rapidly a clear musical sound was produced in the telephone, the pitch rising with the rapidity of rotation. Moreover, the bobbin opposite the circle of 64 holes gave the octave above the other, and each gave a note of the same pitch

as was produced by blowing a stream of air through the corresponding holes."

Electrical Tramcars.—The Paris correspondent of the *Standard* telegraphed on Wednesday night to the following effect:—"The public experiment of an electric tramcar through the streets of Paris will be made to-morrow afternoon, and will doubtless attract a number of sightseers. The new car will leave the Electric Company's workshop in the Place de la Nation and will take the following route:—From the Faubourg St. Antoine to the Place de la Bastille, thence along the Boulevard Henri Quatre and across the Pont Sully to the Boulevard St. Germain. At the Boulevard St. Michel end of the Boulevard St. Germain a short stoppage will be made. The second part of the journey will bring the car to Montrouge, returning to the Eastern Railway by the Boulevard de Sébastopol and the Boulevard de Strasbourg. The Boulevard Magenta will then be reached, and the journey continued past the Northern Railway to the beginning of the Boulevard Ornana. Turning to the left, the whole length of the external boulevards to the Arc de Triomphe, and thence to Passy, will be traversed. The La Muette line of rails will then be followed, *viâ* the Trocadéro, to the Boulevard Haussman, the experiment being completed at the Circular Tramway Office at the end of the Rue Taitbout, whence the car will retrace its journey to the workshops. It will have travelled 45 kilomètres through the crowded streets of Paris."

Electricity at the Board of Trade.—We would call attention to a pamphlet of 24 pages, by Thomas Holmes Blakesley, M.A., A.M.I.C.E., with the above title. It is well worth the perusal of those interested, commercially or otherwise, in the subject of the supply of electricity, and it is published by Sampson Low, Marston & Co., Crown Buildings, Fleet Street, E.C.

The "Brush" Electric Light and Power Company of Scotland, Limited.—We hear a rumour to the effect that at the next meeting of the above company, a resolution to wind up will be submitted. Can this be true?

Magnetisation of Iron and Steel by Fracture.—H. Bissinger.—Rods of iron and steel are magnetised when ruptured on testing their strength. Both have shown approximately equal magnetism. As the rods during the trials are placed in a vertical position, this phenomenon may be due to magnetisation by the earth. —*Wiedemann's Annalen.*

On Thermo-chemistry and Electrolysis.—B. Tommasi. —In opposition to the expressed views of certain other physicists the author emphasises the well-known proposition that the decomposition of equal equivalents of different substances requires different quantities of energy, corresponding to their combination heat.—*Wiedemann's Beiblätter.*

OFFICIAL RETURNS OF ELECTRIC COMPANIES.

London and Derby Electric Wire Company, Limited.—The first return of this company, made up to the 9th ult., was filed on the 30th ult. The nominal capital is £,5000, in £1 shares. 730 shares have been allotted, and upon 260 of these the full amount has been called and paid, and £235 upon the remaining 470 shares, the total paid-up capital is therefore £495. Registered office, 122, Fore Street, E.C.

National Telephone Company, Limited.—The annual return of this company, made up to the 23rd ult., was filed on the 3rd inst. The nominal capital is £600,000, divided into 15,000 preference shares of £10 each, and 90,000 ordinary shares of £5 each, and upon the former £9 has been called up, and £5 upon the latter. 14,999 preference and 90,000 ordinary shares have been taken up, the total calls paid amounting to £585,453, leaving £2,327 unpaid. The sum of £5 has been paid on one share forfeited. Registered office, 11, Queen Victoria Street.

Provincial Telephone Company, Limited.—The annual return of this company, made up to the 23rd ult., was filed on 3rd inst. The nominal capital is £75,000, in £10 shares, the whole of which have been issued, and a call of 7s. per share made in respect thereof, the calls paid amounting to £2,625. Registered office, 11, Queen Victoria Street.

CITY NOTES, REPORTS, MEETINGS, &c.

The Great Western Electric Light and Power Company, Limited and Reduced.

THE first ordinary general meeting was held at Cannon Street Hotel on Monday, Mr. J. B. Braithwaite, jun., presiding.

The Secretary (Mr. A. Smith) read the notice convening the meeting, and the report of the directors, which we published in our last issue, was taken as read.

The Chairman said in meeting the shareholders on the first occasion since he and his colleagues took office the directors had not, perhaps, a very pleasant task before them, inasmuch as they were unable to present to them a balance-sheet which showed a net trading profit on the operations of the company, but at the same time it had been their endeavour, since they came into office, by every means in their power to hasten the time when such a result should be possible. They had succeeded in materially reducing the working expenses of the company; they had also succeeded in materially increasing the income accruing from their lighting stations, and he could not but hope that on a future occasion they would meet under more favourable circumstances. The affairs of the company had been in their hands only for about two months prior to the date of the balance-sheet. During that time they had been unable to do much to reverse the policy of their predecessors; most of the expenditure had been incurred before the present directors took office. During those two months they had raised the income of their lighting stations very considerably—more than 100 per cent.; that was to say, they had more than doubled the income accruing to them from their stations at Bristol and Cardiff, whilst they had effected such reductions in the working expenditure of those stations that, as far as they could judge, they were now paying their way, and they hoped before the end of the winter, with their additional contracts, they would be enabled to pay a small profit. With regard to the report, he had no doubt there were one or two points in it upon which they were anxious to hear him speak. When they came into office they found a large number of legal difficulties surrounding the company. They found that a number of their fellow shareholders had been taking action against the company with a view to the return of the money they paid on their shares. The late directors paid a considerable number of these shareholders, and the present directors immediately took steps to settle the remaining claims as satisfactorily as possible. They stood that day entirely free on that score. They had recovered 941 shares from those gentlemen at a net cost to the company of £274 5s. 3d. In drawing up the balance-sheet, they desired to place the affairs of the company before the shareholders in the clearest possible light, and he trusted if it was not sufficiently plain the shareholders would feel themselves free to ask questions. The trade operations of the company in the past year had resulted in a net loss of £3,801. That was owing to the heavy expenditure incurred by the late board. The directors had succeeded in reducing the expenditure under general charges from £1,196 to about half. The same remark applied to the item of salaries and wages. During the present year the wages at Bristol and Cardiff amount to between £700 and £800, and the income from lighting would more than cover that, so that the position of the company, on the basis on which they were now working, would be that for the past year instead of their having a net loss they would have had a gross profit of £1,500. They stated in the report that the result of the fourteen months' working had been a gross profit of £1,706. In addition to that, there were £848 received for interest on the capital of the company, making a total amount of £2,554. The working charges of the company on the present basis were about £1,100 a year, so that there would have been a gross profit of about £1,500. That was to say, if they only succeeded in doing as much business during the coming year as in the past, they should be £1,500 to the good at the year's end. The income from the lighting stations, too, he hoped, would materially improve. The income was, as stated in the report, over £1,000 on their two lighting stations, and since the date of the report they had had several additional contracts. It might interest them to know what they were doing at their lighting stations. It was, of course, an entirely new business they were trying to establish, and they had to make

their charges on conjecture until the working showed them the commercial basis. At Bristol they had got two 25 nominal H.P. Robey engines. They were in a position to supply in Bristol and Cardiff about 100 arc lights every night. They had the use of the engines during the day, which would enable them to supply 5,000 incandescent lights in various parts. They had sufficient plant to cope with anything that would be required in these two cities during the coming winter. At present they were running the incandescent lights chiefly off the arc machine, which was one great advantage of having a Brush dynamo. The arc lights and incandescent lights were run off the same machine. One 40-light machine was doing all the work they had in Cardiff at present. One single wire was carried round Cardiff, and the lights were distributed all over the town. They were there also lighting several shops, and one newspaper office. They had several groups of incandescent lamps burning, each group taking the place of one arc lamp. Those were working very satisfactorily on the whole. They were enabled by the Brush system to do the thing more cheaply than by any other. They were enabled on that one wire to run arc lights, incandescent lights, and to charge accumulators all off one machine, and that meant an enormous saving in the general installation charges. The rates they charged in Bristol and Cardiff compared very favourably with the rates he had seen quoted in the papers. They were able to compete with gas somewhat favourably in both Bristol and Cardiff, their charges not being more than 10 per cent. over those for gas—gas being in both those towns 2s. 10d. per 1,000. They considered their charges gave them a handsome working profit. If they had their engines fully employed, they estimated that each of their lighting stations would return a profit of about 30 per cent. on the capital thus employed. They had made an arrangement with the Electrical Power Storage Company to act as agents for the sale of that company's accumulators. The storage of electricity was an important feature in electric lighting, and any company would be incomplete which could not supply accumulators to customers as required. It became very important for them to see whether there was any accumulator in the market which was a practicable one, and which might be said to be a commercial one, and they could only find one—that supplied by the Electrical Power Storage Company, the Faure-Sellon-Volckmar accumulator. They made inquiries, and, in fact, he made experiments in his own house with it. He had had it lit for twelve months by means of this accumulator. They had not paid any outrageous sum for this concession—not a single halfpenny, and they should get good trading profit on the number they sold. There were one or two figures in the balance-sheet to which he should like to call their attention. The trade loss, as he had before pointed out, was £3,801, but owing to the money received by the sale of the concession for Devon and Cornwall to the Devon and Cornwall Company for £7,500, they had still some cash in hand to dispose of. With respect to the shares which the directors took in the Devon and Cornwall Company, they would see that they had written them off as having no value whatever; also the shares which they received for the concession. After having done that, and brought down the £3,801 to balance the profit and loss account, they had some £2,500 to dispose of, and the question arose, what they were to do with it. If they wrote something off the value of the concession they came to the conclusion that it would be merely a question of book-keeping on the balance-sheet, inasmuch as the extraordinary expenses incurred during the year in the law proceedings in connection with the Lane-Fox licence and the Devon and Cornwall Company would have to be paid sooner or later, and paid in hard cash, and therefore they thought they would be doing the best for the company if they applied that surplus to wipe off those expenses, and enable them to start with a clean balance-sheet for the new year. That they had done, although he might say none of the law costs were taxed yet, and he dared say there would then be a considerable reduction. They had written off the whole of the cost of the Devon and Cornwall Company's shares, and had written down their plant to the current rates. They were aware that when the company was first started the prices charged by the Anglo-American Brush Electric Light Corporation were considerably higher than they were now. The question naturally arose as to what basis they should follow, and they came to the conclusion that it would be well to write the plant down to the current rates, in lieu of depreciation. They had written it off at the rate of 10 per cent. depreciation for the 14 months, and considering that the plant had not been in use more than six or seven months they considered it was fairly worth the price in the balance-sheet—£5,729. After appropriating these amounts nothing remained to be used in reducing the price paid for the concession. They were alive to the necessity of doing that, seeing that their patents had only 11 more years to run, and it would be their endeavour next year to do something in that direction. He was not without hopes that they might induce the parent company to surrender some of their fully paid shares, but even if that were done they had still paid £20,000 in hard cash for their concession, and therefore they ought to wipe that out at the rate of between £1,500 and £2,000 a year. The next item was the freehold and leasehold land and buildings at Bristol and Cardiff. These they considered good property at the price in the balance-sheet. Their property in Cardiff had a long leasehold. They had 29 years unexpired, and they considered it well worth the price at which they had set it down. They had a certain amount of cash in hand—£22,243 19s. 7d.—and that cash it would be their endeavour not to expend unless they could see their way to make a very good profit out of it for the shareholders. They had provided £300 for a bad and doubtful debt fund, but since the balance-sheet was drawn out they had recovered a portion of the amount, and he did not doubt but that they should recover the whole of it. Looking the balance-sheet fairly in the face, they would see that they had put down every possible liability against the company, and had taken in the assets at as fair a valuation as they could, always understanding that the concession was necessarily brought in at the price they gave for it. In the profit and loss account the most striking item was the heavy expenses incurred by the late Board, amounting to £1,472 3s. 11d. As he had mentioned, the rents, rates, and taxes, and general charges they had reduced to about one-half. They had given up their London offices, and taken others which would cost only about a third the expense of their previous offices. They had also given up their offices in Bristol, all their business there being done at the lighting station. The salaries and wages would be reduced about half. The printing and stationery expenses included the outfit of the company, in the way of ledgers, books, &c. The travelling expenses he thought would be greatly reduced. The directors' fees and expenses amounted to £1,484 4s. 11d., and of that amount £1,472 3s. 11d. was incurred by the late Board. The present directors had only spent about £12 in travelling expenses since they came into office; and he might mention that his colleagues and himself had come to the conclusion that they ought to take no fees whatever up to the 30th June, and during the current year they proposed to draw only half the amount the Articles of Association provided—namely, £500, instead of £1,000, and he hoped they would prove themselves to be worth their money. The £500 was included in his estimate of £1,100 as the working expenses of the company. He did not think there was any other item he need call their particular attention to. They would, however, ask what were the prospects of the company. Two months of the year had already elapsed, and during that time they had not been able to do as much as they should have liked, chiefly owing to the delay in the publication of the new pamphlet the Anglo-Brush Company were bringing out. The Anglo-Brush Company had made a great improvement in their incandescent lighting machines and lamps, and a new pamphlet was required giving the latest improvements. He had received a proof sheet of it, and hoped it would be published shortly, when their agents would be able to set to work. With regard to the Devon and Cornwall district, the moment the Devon and Cornwall Company went into liquidation the district reverted to them, and they were in a position to work it. The water power available at Ilfracombe and other parts was, he thought, the most hopeful feature in the whole district, as the cost of the turbines would be very much less where they had a good head of water than where they had not. Some of them might have seen the last number of the ELECTRICAL REVIEW, in which was a notice of the Brush lighting station in Rochester, in America, where water power was used, and it would give them a good idea of what they hoped to do. In Rochester they had eighteen of their forty light machines, and were proposing to add nine more. By using water power the cost was very much reduced, inasmuch as they saved in coal and the wages of their engine-driver and stoker. The cost was the cost of the carbons, the depreciation of the plant, and the outlay on the installation. Another source from which the company ought to derive a considerable profit was from the sale of plant for isolated installations. That they should endeavour to do to the utmost as soon as the pamphlets were published. It was the most satisfactory branch of the business, as it did not employ any of the capital. He could not but think that during the coming winter a good deal more would be done in that way than was the case last year. They had had more inquiries in regard to lighting during the last three weeks than they had had during the whole of the previous time they had been in office. People were beginning to recognise that electric lighting was not a mere experiment, but was coming into practical use, and was now only a question of pounds, shillings and pence, and when they came to that the Brush system had the advantage over every other system in the field. They could supply the electric light at very much the same price as gas, even where the cost of the latter was lowest, and in any town where gas was 4s. per thousand feet, they could supply the electric light at a cheaper rate. He moved the adoption of the report and balance-sheet.

Mr. F. W. Reynolds, in seconding, said he believed most fervently that the prospects of the electric light at the present moment were better than they ever were before, and they might rely that everything the directors could possibly do to bring the company into a paying condition would be done.

Mr. Offor, in a lengthy speech, gave it as his opinion that the shareholders must be satisfied with the business capacity of their present board of directors, and that ere long the public would have the same facilities for adopting the electric light as they at present had in regard to gas.

In answer to a question,

The Chairman said the liquidation of the Devon and Cornwall Company had not made sufficient progress yet to enable them to form any idea as to whether there was a likelihood of a further call, but he imagined not, seeing there was a considerable amount of cash in hand.

Mr. Hildyard: Are we still liable for the £2 10s. on the shares?

The solicitor, Mr. Slaughter (of Ashurst, Morris & Crisp): Yes, certainly, until the court makes a final order for the reduction of the capital.

The report and accounts were then unanimously adopted.

Messrs. Turquand, Youngs, & Co. were elected auditors for the ensuing year at a remuneration of 25 guineas.

A vote of thanks to the chairman and directors closed the meeting.

The Mediterranean Extension Telegraph Company, Limited.

AN extraordinary general meeting of the shareholders was held at Cannon Street Hotel, on Monday, Mr. Ashley Ponsonby presiding.

A brief report, and also a balance-sheet, showing the financial position of the company for the half-year ended the 30th June last, was submitted to the meeting. The revenue account showed —EXPENSES at the offices and stations in London, Malta, and Corfu, including directors' fees, viz.: salaries, wages, and agencies, £1,128 16s. 7d.; rent, fuel, and light, £185 11s. 2d.; maintenance of the lines, &c., £45 8s. 9d.; miscellaneous and petty expenses, £130 9s. 9d.; balance available for dividends, £409 9s. 6d., and income tax thereon, £8 14s. 3d.; total, £1,908 10s. RECEIPTS for messages, £1,908 10s. The amount to the credit of reserve fund was £13,694 10s. 8d. LIABILITIES:—amounts owing on account of messages transmitted over other lines, £8,395 6s. 6d.; sundry amounts owing by the company, £189 4s. 8d.; balance of revenue account, less income tax, £409 9s. 6d.; total, £22,688 11s. 4d. ASSETS:—Funded property (amount invested in New Three and New Two-and-a-half per Cents.), £13,444 1s.; amount due from other lines on account of messages transmitted by this company to 30th June, 1883, £3,220 13s. 2d.; sundry amounts due to the company, £20 18s. 5d.; cash in hands of officers of the company, £788 13s. 3d.; cash at bankers, £1,832 5s.; short bills in hand, £3,382 0s. 6d.; total, £22,688 11s. 4d.

The Chairman, in opening the proceedings, said he was unfortunately in the position of being the only director, for, since they last met, they had lost their late chairman, Sir James Carmichael, and also Mr. Robinson. He was sure he hardly needed to express the deep regret they all experienced at the loss of Sir James, who was to him a great friend and an able colleague. They all knew how, during the many years he was their chairman, he gave his best attention to the interests of the company, and how genial he was and kind, and how satisfactorily he carried out the duties of his office; and, while they lamented his death, they could not in a sense be sorry that he was absent on the present occasion, seeing that they had met to consider the advisability of liquidating the company. He might speak similarly of Mr. Robinson, for he also devoted unusual energy in the interests of the shareholders; and it was with deep regret he realised that he was no more. To come to the business of the meeting—they had met to consider a petition which had been presented by Mr. Hurst, from whom they had received circulars, and who held 300 shares. That gentleman was of opinion that the company should be wound up compulsorily, but he (the chairman) had to warn them that if they adopted Mr. Hurst's views they would probably have little to receive for themselves, for, as they would all know, and as experience taught them, compulsory winding-up left little for shareholders, and not even much for creditors.

Mr. Atrell: Who is Mr. Hurst?

The Chairman: Mr. Hurst is a stockbroker, and holds, as I say, 300 shares.

Mr. Atrell: I thought so. How long has he been a shareholder?

The Chairman: I don't know.

Mr. Atrell: Not long.

The Chairman suggested that it would be better to put questions to him after he had finished his statement. Mr. Hurst, no doubt, was perfectly right in his opinion that the company should be wound up. They were unable to pay the preference holders, and it was better that the company should not go on till all its assets were wasted, and nothing left for the shareholders. He did not, however, agree with Mr. Hurst that the company should be compulsorily wound up. He would prefer that it should be done voluntarily. He had taken upon himself to instruct their solicitor to move the Court for a postponement of the matter until the views of the shareholders could be obtained, and the petition was now held over till November. The question, therefore, to consider that day was whether there should be a voluntary or a compulsory liquidation. Since the death of Sir James Carmichael he had, to the best of his ability, been negotiating with certain companies for the purpose of getting this concern bought up. These companies were, in fact, if he might be permitted to say so, the only people who could buy; but he had met with difficulties to a certain extent, and he was sorry to say he was not able to meet with so large an offer as was proposed to them in November last. It was safe, however, and he thought it would be well for the shareholders, when the proper time came, to consider whether it would not be wise to accept it. They must be aware that their receipts for the five years ending 1882 were £22,220, giving a yearly average of £4,444.

A Shareholder: Does that include the subsidy?

The Chairman replied that it did not; that it was the receipts of the company. They had now £1,444 to the good, but that would not meet the interest of the preference shareholders; and there was nothing left for the repairs of the cables, and nothing for a reserve fund and for working expenses, and he therefore thought he was justified in doing his best to obtain an offer for the purchase of their lines and concessions. Taking everything into consideration, he thought the wisest plan for them was to try to effect a sale. Papers would be submitted to the shareholders for their consideration as soon as the preliminaries had been settled. It came to this, whether the company was to be wound up voluntarily or compulsorily, and he had in his hand a resolution—"That the company be wound up compulsorily by the order of the Court, in compliance with the terms of the petition presented by Mr. Frank Hurst, of No. 7, Draper's Gardens, in the city of London, stockbroker." Did Mr. Hurst wish that moved?

Mr. Hurst said as the chairman apparently was of opinion that they must wind up the company, he did not wish to go to the expense of a compulsory liquidation, and if it could be agreed to wind up in a voluntary manner he should not put his resolution; he withdrew it.

On the motion of Mr. Atrell, seconded by Mr. Parnell, it was then unanimously agreed—"That the company be wound up voluntarily under the provisions of The Companies' Acts, 1862 and 1867."

It was also agreed, after a brief discussion—"That the Honourable Ashley Ponsonby, a director of the company, and Mr. John George Griffiths, a shareholder, be appointed liquidators for the purpose of such winding up, and that the remuneration to be paid to such liquidators shall be left to the decision of the shareholders at a future meeting."

On the suggestion of the Chairman, the balance in hand (£409) was handed over to the liquidators to defray possible expenses.

It was resolved that a letter be written to Lady Carmichael, expressing the deep sympathy of the meeting with her in her great loss.

A vote of thanks to the chairman closed the meeting.

The Telephone Company of Ireland, Limited.

THE following is the report of the directors for the five months ending the 30th June, to be submitted at the half-yearly ordinary general meeting of the proprietors, to be held at the offices of the company, Commercial Buildings, Dame Street, Dublin, on Friday:—

The company's business has again been most satisfactory. The monthly progress in the number of subscribers to the exchange system of the Dublin district, and also in the number of renters of private lines, is shown as follows, which sets out the number of exchange subscribers and the number of renters of private lines respectively, as they stood on the last day of each month during the period covered by this report: 31st January, 301, 105; 28th February, 320, 108; 31st March, 341, 113; 30th April, 366, 117; 31st May, 388, 124; 30th June, 411, 127. It will be observed that the increase for the five months is 36 per cent. on the number of exchange subscribers, and 20 per cent. on the number of renters of private lines, showing a rate of development of the company's business, which is most encouraging. The accounts with the United Telephone Company for expenditure on fixed plant, &c., up to the 31st July, 1882, which were open at date of last report, have now been closed, and the total amount paid to that company on this account is £5,259 1s. 11d., in place of £5,897 14s. 8d., which was the sum estimated and which appeared in suspense upon the last balance-sheet. An agreement has been concluded with the Corporation of Dublin, in pursuance of which the principal offices of the Corporation and the Fire Brigade stations are now in connection with the company's exchange. The directors have endeavoured to keep the system in the highest state of efficiency, and with a view to render it of the greatest possible convenience, communication within the city boundaries has been maintained continuously day and night since the 1st July last without extra charge to the subscribers. The area covered by the license for Dublin held by the company from the Postmaster-General, is limited at present to a radius of four miles from the central post-office. As the residences of a large number of the company's subscribers lie outside this district, the directors have made application for an extension of this area, so as to enable the company to bring the residential suburbs of Dublin in connection with the exchange. If this be accomplished, the directors anticipate that it will add much to the usefulness of the system, and aid largely in the development of the company's business. The balance standing to credit of profit and loss account admits of payment to the preference shareholders of the full dividend, at the rate of 6 per cent. per annum, upon the amounts paid upon their shares; and the directors propose to carry forward the balance to the credit of the profit and loss account for the current half-year. The shareholders are to be congratulated that this balance so carried forward is sufficient, within £40, to pay the 6 per cent. preference dividend for the half-year ending 31st December next, the due payment of which is thus already assured. In view of the greatly improved position of the company, and the rapid extension of its business, which must ultimately require a considerable expenditure of capital for its full development, the directors are of opinion that the nominal capital of the company may now be increased from £200,000 to £250,000, the ordinary share capital remaining as at present at £175,000, and the remainder—£75,000—to be in preference shares of £1 each; that £50,000 of this preference capital, bearing a 5 per cent. preferential and cumulative dividend, should be issued, that 10s. per share only should be called up, and that the holders of the existing £25,000 preference capital shall be invited to convert their 6 per cent. shares into £30,000 new 5 per cent. shares at the rate of £100 6 per cent. shares with £50 paid up and a liability of £50, into £120 5 per cent. shares credited with £60 paid, and under a liability of £60. The dividend upon the £120 new 5 per cent. shares would thus be equivalent to the dividend upon the £100 6 per cent. shares, so that no additional

burden would be thrown upon the company by reason of this conversion, whilst the nominal or face value of the existing shares would be increased by 20 per cent., which would obviously be a great advantage to the holders.

The revenue and profit and loss account for the five months ended 30th June last, showed that the working expenses had been £516 0s. 2d., that the proportion of royalties paid had been £335 1s. 1d., and that the management expenses totalled £388 16s. 4d. Exchange rentals realised £1,607 19s. 2d., and private wire rentals £320 18s. 11d., which, with one or two other items, including interest on investments, £65 12s. 3d., brought the credit side of the account to £2,025 11s. 3d. There was thus a balance, which was a net profit for the five months of £624 17s. 9d. To this balance £17 12s. 2d. had to be added, being the amount left of the balance from the last account, after the payment of £120 15s. as directors' and auditors' fees.

The Eastern Telegraph Company, Limited.—This company notifies that the rate to Monte Video and other places in Uruguay is now reduced to 11s. 1d. per word.

TRAFFIC RECEIPTS.

The Cuba Submarine Telegraph Company, Limited. The number of messages passing over the lines during the month of August was 2,470, estimated to produce £2,275, against 2,579 messages, producing £2,595 in the corresponding month of last year. The traffic receipts for the month of May, estimated at £3,300, realised £3,576.

The Direct Spanish Telegraph Company, Limited. The estimated receipts for August were £1,514, against £1,790 in the corresponding period of last year.

The Eastern Extension Australasia and China Telegraph Company, Limited. The receipts for the month of August amounted to £38,128, and to £32,025 for August, 1882, an increase of £6,10[illegible].

The Eastern Telegraph Company, Limited. The estimated receipts for the month of August amounted to £44,937, and to £50,868 in the corresponding period of 1882.

The Great Northern Telegraph Company. The receipts in August amounted to £22,360, from the 1st January to the 31st August to £168,040, and in the corresponding months of 1882 and 1881 to £161,145 and £158,240 respectively.

The West India and Panama Telegraph Company. The estimated receipts for the half month ended the 15th August are £1,958, as compared with £2,358, and for the half month ended the 31st August £2,634, as compared with £2,004 in the corresponding periods respectively of 1882,

The Western and Brazilian Telegraph Company, Limited. The receipts for the week ending 17th August were £1,670, after deducting the "fifth" of the gross receipts payable to The London Platino-Brazilian Telegraph Company, Limited.

NEW PATENTS—1883.

4171. "Electrical insulators." J. H. JOHNSON. (Communicated by G. Westinghouse.) Dated August 29th.

4177. "Dynamo-electric machines." H. H. LAKE. (Communicated by G. W. Fuller. *Complete.* Dated August 29th.

4180. "Automatically opening, closing, and controlling or directing electric currents." F. C. PHILLIPS. Dated August 29th.

4192. "Dynamo-electric machines." H. H. LAKE. (Communicated by G. W. Fuller.) *Complete.* Dated August 30th.

4197. "Secondary batteries." D. G. FITZ-GERALD, T. J. JONES. Dated August 30th.

4219. "Voltaic piles." E. EDWARDS. (Communicated by A. Schroeder.) Dated September 1st.

4220. "Transmitting signals by means of electricity." A. F. ST. GEORGE, C. A. MCEVOY. Dated September 1st.

4243. "Galvanic batteries." A. GUTENSOHN. Dated September 3rd.

4247. "Telephonic transmitters." E. A. ALLISON. (Communicated by D. Drawbaugh.) Dated September 4th.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1882.

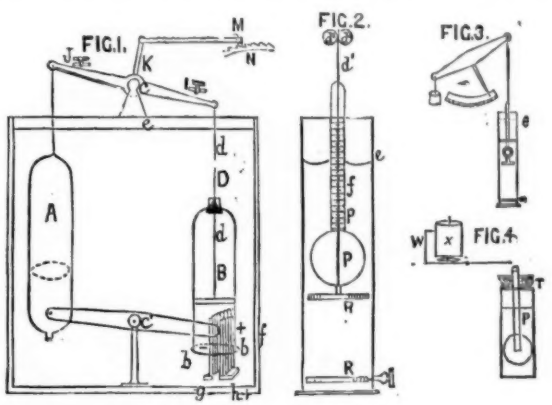
5779. "Electric lamps, &c." ALFRED FERGUSSON. Dated December 5. 6d. This invention relates to that class of electric lamps in which the light is formed in a vacuum and to electric switches by which the current is turned on and off therefrom.

6046. "Electric lamps or lighting apparatus." HENRY HARRIS LAKE. (A communication from abroad, by Jean Kremenezky, of Vienna, in the empire of Austria.) Dated December 18. 2d. This invention relates to electric lamps, one or more of which can be used in a single circuit. The said invention comprises improved regulating apparatus, suitably arranged in connection with solenoids, which serve for operating the same. It also comprises the general construction of the lighting apparatus and details thereof. (*Provisional only.*)

6067. "Electrical gas lighting apparatus." SAMUEL EDWIN PATTISON. (Communicated from abroad, by William A. Drysdale and Charles W. Bailey, both of Philadelphia, United States of America.) Dated December 19. 2d. The said invention relates to certain improvements in that class of electrical gas lighting apparatus, in which the gas is automatically turned on or off, and the gas ignited by electrical devices. The main objects of the said invention are to construct the apparatus, so as to ensure the positive opening and closing of the gas cock, prevent the clogging of the said cock, and utilise all the power of the electro-magnet, together with details of construction. (*Provisional only.*)

6102. "Insulator for telegraphic and like wires." ALFRED GUSTAV BOSSOMAIER. Dated December 21. 2d. Relates to a new or improved construction of insulator for supporting telegraphic and like wires, with easy and ready means of inserting the wire or wires therein and of their removal therefrom. (*Provisional only.*

6105. "Electric meters." FREDERICK HENRY VARLEY and JOHN RONALD SHEARER. Dated December 21. 6d. The invention consists in the application of apparatus or contrivances whereby the well-known properties of an electric current to decompose fluids into their constituent gases or elements, or to deposit metals from a solution of a salt of such metals, is or are made to record the amount of current passed during any given period of time. Fig. 1 represents one form of constructing the recording water voltameter. A is a counter-float, charged with air, and B, the voltametric gas receiver—C and C^1, oscillating beams, which permit the receiver, B, to ascend or descend vertically. D is a valve attached to the rod, *d*, *d*, which is suspended from one end of the oscillating beam, C. F represents the trough, filled with acidulated water, or other suitable fluid, to the level of *e*. — + represent the electrodes for decomposing the fluid into gas, to charge the receiver, B. *g* and *h* the leads from the source of current to be measured. I and J are adjustable stops to regulate the movement of *c*. The receiver, B, is filled with the acidulated fluid, and is held in the position shown in drawing by counter float, A; the beam, *c*, striking the stop, J. When the amount of accumulated gas in the receiver, B, is greater than that

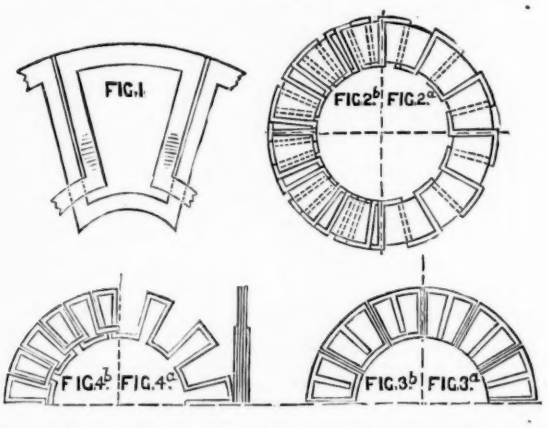


of the counter-float, A, it rises until the rod, *d*, *d*, raises the oscillating lever, *c*, until it is arrested by the stop, I, after which the receiver, B, continues to rise until the orifice of the dome-shaped top of B is opened, and the upward pressure of the fluid forces out the gas, when the same immediately descends by the buoyancy of the counterfloat, A, in so doing actuates the lever, K, and link, L, to which is attached the pawl, M, thus propelling the ratchet wheel, N, which is connected to recording mechanism or indicating apparatus. The chambers or floats, A and B, are regulated for a definite amount of current. Each rise and fall of voltametric receiver being recorded. Figs. 2 and 3 show arrangement whereby a graduated float is made to indicate the amount of current by the electro deposition and dissolving of metals. *f* is a chamber filled to the level of *e* with a suitable solution, in which floats a hydrometric float, *p*, the lower part carrying an electrode, R, below which is a second electrode, R^1; the wire, d^1, is connected to R, and by means of the contact rollers, d^2, d^2, to one pole of the current, the other pole being connected to the terminal of R^1. If the current is so directed that the plate R^1 dissolves, then R obtains a corresponding deposit of metal, which increases its weight, causing it to descend, the increase being indicated by the index as in hydrometers. By reversing the direction of the current to reduce the weight of R, a reverse action takes place. Fig. 3 is the same as fig. 2, the registering being indicated by a pointer and scale, as shown, with the addition of a counter-weight. Fig. 4 shows a modification of the invention, whereby the graduated float, *p*, carries a solenoid or iron core, *s*, capable of passing freely through the attracting coil or solenoid, T, on passing a current around and through T. If an iron core or solenoid be employed, the same is attracted, and the graduated float is drawn out of the water until its weight equals the force of attraction, and by applying a lever, *b*, and tracing pen or pencil, *w*, as shown, the force is registered on the drum, *x*, which is made to revolve by any suitable means. It is also obvious that by using a float with a graduated stem or tube, the same can be employed as an indicating meter. This latter arrangement may be employed in conjunction with either of the forms of meters described, to show at any given time the variation in the force of the charging current in ampères, or by using a suitably wound helix or helices to indicate the potential in volts, or by combining two helices, one made of fine wire for potential, and the other of thick wire, the apparatus will give the readings in Watts.

6114. "Photometric apparatus." STEPHEN HENRY EMMENS and JOHN MUNRO. Dated December 22. 6d. This invention relates to photometrical apparatus, depending for its action upon the employment of light absorbing media, and the apparatus is constructed in several modifications, corresponding to its varied applications.

6118. "Receptacles or vessels of secondary batteries." GUSTAV BINSWANGER. Dated December 22. 2d. This invention relates to improvements in the manufacture and construction of the receptacles or vessels to be used as a portion of the apparatus composing secondary batteries or electrical accumulators. (*Provisional only.*)

6146. "Dynamo-electric, magneto-electric, or electro-dynamic machines." ROBERT MATTHEWS. Dated December 23. 8d. The invention has for its object the construction of disc armatures or electro magnets for the above machines in such a manner that the lines of force from the field-magnets are always enveloped by the coils on the armature, and not one half merely, as is usual in some machines. The armature is by preference constructed of sheet copper discs placed side by side in a plane at right angles to the axis of rotation, and cut or stamped as in fig. 1, or in some cases cast of suitable section so as to form a number of single or multiple coils connected together, so that the current circulates in opposite directions in the contiguous coils. When the multiple coil is used, the inner end is attached to the upper end of the next similar disc, so as to have no projections in the way of the magnets. The discs for single coils are cut, stamped, or cast, to form zig-zag spaces alternately inside and outside, as in fig. 4A, and into the outside spaces, which are not enveloped by any coils, the inventor arranges another such disc as in fig. 4B, the inner parts being bent or pressed out of the plane of coil to clear the next coil when they pass each other, or in some cases the material is made wider and thinner at that part, so that the exterior surfaces are level. Another part of the invention consists in making the armature similar to the Gramme ring, but with the wire strips, bars, or discs made to describe an irregular coarse pitch thread, as in fig. 2A, the sides being radial, the number of internal enclosures being equal to the number of like polar magnetic fields, round a core of either magnetic or dia-magnetic material. This arrangement allows of a number of radial magnets being used as in other disc armatures, thus allowing a greater number of fields being used, and getting the poles much nearer, and getting the advantage of continuous currents for some cases. The whole core would be wound as in fig. 2B, until covered and coupled up to suit the requirements. For continuous currents with the first mentioned disc armature, the discs are placed in advance of each other, so that the pairs of coils or discs are not at their maximum induction at the same time. The discs are coupled up in series, or any way, to suit the requisite electromotive force. In some cases, when the electromotive force is small, especially for large machines, the armature is made as in figs. 3A and 3B, in which case the sections may be cast separately and coupled up to suit the tension of current required.



6164. "Apparatus for production of electric light." ALEXANDER MELVILLE CLARKE. (A communication from abroad by Léon Gerard, engineer, Professeur agrégé à l'école polytechnique de Bruxelles, and William V. Bonsor, engineer, both of Brussels, in the kingdom of Belgium.) Dated December 23. 8d. This invention has for its object—1st, the simplification of dynamo electric machines, the modification of their mechanical construction, and general dispositions to increase the intensity of the magnetic field and its action upon the armature by the particular form of the pole pieces. Also to maintain the field at a determined intensity, and be able to render the field or inducing current distinct from the exterior current, without the assistance of an auxiliary dynamo. To allow in a modified form of dynamo having several armature rings on the same shaft with their respective collectors, and under the influence of the same field-magnets, of obtaining from the same machine so constituted, currents of high and low tension simultaneously, and distributed in different circuits. And to simplify and improve the form of the commutators or collectors by making the contact surface plane.

CORRESPONDENCE.

Patents for Telephones.

"Leetle, leetle boy, you may well ask which is which—there never was two such likenesses;" such was the facetious reply made by an itinerant showman of two life-size equestrian portraits, purporting to represent the Duke of Wellington and Napoleon Buonaparte. This incident of the showman has been forcibly recalled to my mind on viewing the drawings in several patent specifications at the Patent Office.

One of these drawings can be found in the specifications of patent No. 922, dated February 25th, 1882, granted to Arthur French St. George. This drawing, placed side by side with that in Morgan Brown's patent for Bell's telephone, suggests the inquiry "which is which, for there never was two such likenesses."

The description of this *invention*, so called, naturally leads one to attribute to the writer thereof an attempt to use the diplomat's prerogative, namely, that of using language to conceal his intentions. All men are not, however, successful diplomats, and the attempt here is so lame and impotent that, despite of the circuitous verbiage, the intention fails in its object. The disguise is too thin to conceal the Bell receiver under its film. The inventor—I use the word inventor, not to designate a person who has made a discovery, but as a person who has *found* something, the word being derived from the Latin word *invenere*, to find. The inventor writes: "My invention consists in the employment of iron or steel wire in such apparatus, and combining it with the circuit in such manner as to influence the latter by inductive action. . . . I arrange the iron or steel wire in connection with a resonant surface (a vibrating diaphragm of wood), so that any sound, such for instance as the human voice, when made to impinge upon the resonant surface, causes the latter to vibrate in such a manner in rotation to or in combination with the iron or steel inducting wire as to cause corresponding electric currents or variations in the circuit." This description of the "*invention* (?) and the manner in which it is to be performed" are certainly defective, especially about the "variations in the circuit." Failing to draw from this description what is the invention claimed, I turn to the drawings, and what do I find there? simply a resonant plate, made capable of inductive action, held down all round its edges in front of, close to, and not touching the pole of a magnet, upon the end of which is a bobbin wound with covered wire, the said wire forming part of the line circuit. The specification, or rather one of the claims, is for such an instrument to be used as a transmitter or receiver.

I submit that a correct and true description of this instrument is a correct and true description of Bell's receiver, as concisely set forth in the sixth claim of Morgan-Brown's patent, which is in these words:—

"The combination with an electro-magnet of a plate of iron or steel, or other material capable of inductive action, which can be thrown into vibration by the movement of surrounding air, or by the attraction of a magnet."

I will now ask "was there ever two such likenesses?"

Another patent, No. 6,020, dated 16th December, 1882, granted to George Lee Anders and John Benjamin Henck, when placed side by side with Edison's patent, No. 2,909, dated July 30th, 1877, suggests the inquiry "which is which, for there never was two such likenesses?"

Edison's solitary claim remaining out of his 30 original claims is in these words:—"In an instrument for transmitting electric impulses by sound, the combination with a diaphragm or tympan of electric tension regulates substantially, as herein-before described, for varying the resistance in a closed circuit, substantially as set forth."

The writers of the specification of this *new* (?) invention describes a modification of their invention (?) in the following words:—"This instrument consists of a metallic diaphragm, fixed in a horizontal position, and

carrying at its centre a button of hard carbon or other suitable conducting material. Upon this button rests another similar one, mounted as in the Reis transmitter, so as to follow the vibrations of the diaphragm. Thus far this description describes Edison's transmitter, which Mr. Justice Fry decided to be the combination of a diaphragm or tympan with a tension regulator. In addition, however, to the button of carbon, "thin strips of metal are placed over the diaphragm, but not touching it, and a quantity of granulated coke is placed upon the diaphragm so as to come in contact with the metal strips." Can any one think that this addition, or rather increase of contact points of the tension regulator, places the instrument outside of Edison's claim?

The inventors (?) of this instrument have shown great ingenuity indeed, for they have made an instrument, not only like unto one other, but like unto three others.

Does not Hunning's patent claim "the use of finely-powdered carbon or like conductor in a loose and free state, as a means of varying the resistance in a telephonic circuit by the vibrations of a thin metallic or metal-covered diaphragm?"

Another striking likeness to this instrument is presented in Husbands' patent, No. 3008. June 24, 1882. The drawings No. 1 of this patent are identical in construction with the drawing No. 1 of this instrument, with the exception that, in addition to the granulated coke, there are carbon button contacts. Fig. 4 of this invention, showing a divided diaphragm, is marvellously like unto figs. 15 and 16 of Husbands' patent, and fig. 19 of Husbands' patent shows "the combination with the divided disc, of the carbon pieces, the carbon ball, or rod, and the granulated or powdered carbon, as described in claim No. 2.

I dismiss this invention (?) with the words "*par nobile inventorum rem invenevit passim*," specifying, however, that I use the word *invenevit* in its true sense —that is "found."

"The cry is still they come."

Patent No. 676, dated Feb. 7, 1883, granted to H. H. Eldred, is worthy of notice, because of the childlike simplicity of the getter up of the specification, which betrays a total unconsciousness of the existence of Bell's invention, which is the more surprising as the getter up was a defendant in the action for infringement, tried before Mr. Justice Fry, in Jan. 1882, and also on appeal before the late eminent jurist, Sir George Jessel. The claim of Bell and the description of Bell's instrument, by both judges, are too well known to need reciting here. I will merely cite the claims set forth in the specification of Eldred's patent. 1st claim. In an electro-magnetic or magnetic telephone the combination of a membraneous diaphragm carrying a piece of metal capable of inductive or magnetic action, and a disc of thin mica, brass or other material incapable of inductive or magnetic action, or a waterproof equivalent therefor.

3rd claim. "In an electro-magnetic or magnetic telephone the employment of a diaphragm made of mica, brass, or some stiff material not requiring to be strained upon a ring and incapable of inductive action, having at its centre a thin disc or piece of iron or other metal capable of inductive action.

This inventor (?), also says he may use two discs of paper, having a piece of tin-plate or iron placed between them; or the surface of the paper or membraneous diaphragm may be coated with a solution of india-rubber, shellac, or other water-proof varnish, the disc in all cases to be gripped between two rings. Sometimes also he dispenses with the paper, and uses a disc of brass, mica, or equivalent, with a thin piece of iron in the centre.

For these wonderful improvements I cannot give to the inventor (?) any meed of ingenuity, the attempt to disguise a Bell telephone by adding to it something, which not improves but impairs its efficiency, is too glaring.

I will simply remark that a diaphragm of any material which is stiff, or which is rendered stiff by any process, having attached to it any material capable of inductive or magnetic action, placed in front of the pole of a magnet, comes clearly within Bell's patent.

W. C. Barney.

September 3, 1883.

[We would, in reference to the above letter, point out that it must not be forgotten that a modification of a previous patent may be of considerable value. Although the modifier cannot use his patent without an arrangement with the first patentee, this latter cannot use the improved modification without the consent of the inventor thereof.—EDS. ELEC. REV.]

The Theory of the Gramme Ring.

In *La Lumière Electrique* of August 25th, there appears a critical exposition of an article upon the Gramme ring, published in the REVIEW (June 16th), and extracted from a work by me on the Law of Electric Lighting.

As the article in *La Lumière Electrique* is signed Th. du Moncel, I need hardly say that it is written with the clearness and force which always distinguishes the works of this eminent electrician. If I understand the Comte du Moncel right, he does not impugn the correctness of my explanation, but prefers the French method.

The difference between us chiefly is, that although we agree in treating a revolving Gramme ring as a series of helices sliding round upon an iron circular core, magnetised partly by the field-magnets and partly by the current generated in the helices, yet the Comte du Moncel makes no use of the conception of the lines of force proposed by Faraday; nor, as he remarks, "are the French as yet familiarised with them." In my explanation I had laid great stress on the necessity of a correct appreciation of the lines of force traversing the field in which the armature revolves. I venture to repeat this opinion. I maintain that it is impossible to understand the action of any given dynamo, without forming a very clear conception of every part of the magnetic field in which the armature is revolving, and noting, at every point, not merely the nature of the magnetic field, but also its strength, and the direction of the resultant magnetic action.

It is not enough to treat a helix as sliding on a magnetised bar or core of any particular form; we ought also to know the strength and direction of the magnetic forces radiating from the magnetised bar;—forces which will alter in magnitude and direction with every magnetic change either in the magnet or in the space surrounding it, and which will determine the currents produced in the revolving helices. I am not aware of any theory which so clearly enables the mind to form a conception of these lines of force as Faraday's theory, which has the advantage, too, of being in complete harmony with the mathematical mode at present in use for treating attractions by by means of "tubes of force."

As a further example how convenient this method of examining the action of armatures is, let us take the unipolar machine, which has been of late a subject of discussion in this and contemporary journals.

The unipolar machine consists in theory of a gramme ring to which only one pole of a magnet is presented. I say in theory, because this is not exactly the case in the machines as practically constructed.

If the field of such a machine be explored by means of iron filings sprinkled on paper, or by using a small compass, diagrams of the field of force may be prepared which will be approximately represented in plan and section by figs. 1 and 2, which show that in the unipolar machine the theoretical points for the application of the brushes are at M and R, and that the lines of force proceeding from N flow into the ring and round it, and then issue from all parts of the internal surface of the ring towards a confluent point P, at which they meet, and then flow away into space on each side in planes inclined to the plane of the ring. Therefore, during the passage of a helix sliding on the ring from M to R in the direction of the arrow

every portion of the wire in the helix, both external and internal, would be cutting lines of force in a manner calculated to produce useful currents, while in the passage of the helix from R to M only the centre part of the interior wires would be idle or detrimental, and that only if the ring was rather wide. These considerations seem to explain the considerable currents

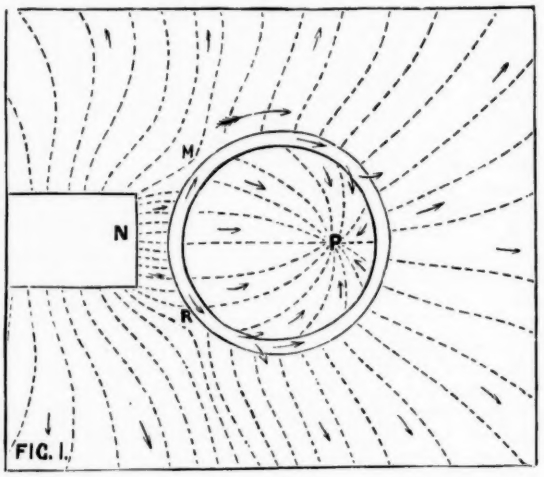


FIG. 1.

which unipolar machines appear to be capable of giving. The position of the point, P, will depend on the thickness of the ring and its capability for conveying lines of force through the iron composing it. In fact, at P, two series of lines of force meet, one

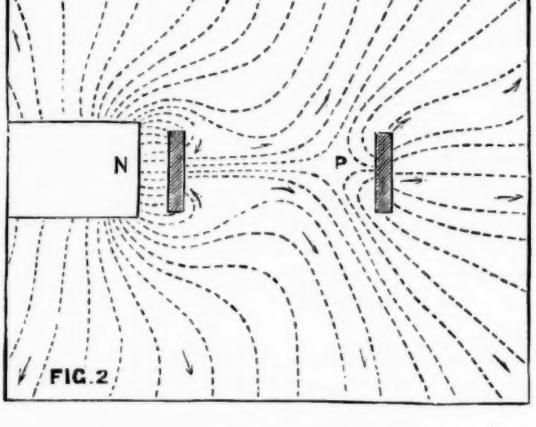


FIG. 2

which has traversed the air space in the interior of the ring, the other, which has preferred the longer, but easier path round through the metal, and the position of P is such that these two paths are equivalent in resistance.

As soon as the ring begins to revolve and a current is generated in the helices, the brushes will require a forward lead because the magnetic field will now be disturbed by the formation of new magnetic poles at the points of entry and exit of the current from the armature coils.

These and other examples, I think, show the value of the above method, which does not conflict with, but, on the contrary, amplifies and improves the explanations given by the Comte du Moncel.

A very convenient instrument for examining the field of force may be made by suspending a small magnet about one-quarter of an inch long by its centre from a short silk fibre, the other end of which is fastened to a piece of wood as to a fishing rod. This needle can be moved to all points of the magnetic field, and will indicate the direction of the resultant attraction, and by the rapidity of its oscillations afford approximate means of judging of its strength.

H. Cunynghame.

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Electrical Inter-communication on Railways.

In your issue of the 14th July last, you state that, "Electrical communication between passenger and guard has been frequently dealt with, but no really satisfactory solution of the problem has yet been obtained." If a perfectly successful working, during nearly five years, of all the trains, passenger, goods and mixed, on a Railway 850 miles in length, with between three and four thousand vehicles, may be said to be sufficient evidence that a solution of the problem has been found, I think it must be admitted that, to the Madras railway belongs the credit of having solved the problem. I enclose a pamphlet in which the system is described, and which has already been republished in your journal. I also send you a copy of our rules extracted from the working time table. The means of communication has been used in several cases of emergency by the public, is much used and greatly appreciated by the guards and drivers, and is regularly tested on passing through every station, by an all right signal being given by the guard and acknowledged by the driver, after the outermost points have been passed. The daily train mileage worked is about 5,000, and I think I am correct in saying that no system has ever previously been attempted on so large a scale. I am now, at the request of Government, fitting the apparatus to Rajputana and Malwa Railway, and I have every reason to hope that sooner or later the system will be generally adopted on the Indian lines. In conclusion, the advantages of the system are as follows :—1st. As no extra couplings have to be made the chance of failure in consequence of neglect or carelessness in forming trains is very much less than it would be were special couplings employed, in fact the risk of failure from this cause is reduced to a minimum. 2nd. No extra work whatever is given to the porters in forming or shunting trains, consequently no loss of time is involved, a matter of very great importance, where, as in India, trains are being continually altered in the course of their journey. 3rd. The chains form a protection to the necessarily more fragile cable, which forms the electrical coupling.

G. K. Winter.

Madras Railway Company, Telegraph
Engineer's Office, Arconum,
August 11*th*, 1883.

Patents for Inventions Act, 1883.

I have read Mr. Varley's communication on the above subject, republished in your last issue. As I am acquainted with all the circumstances of the case to which he alludes, having been engaged with him upon it, will you allow me to make an observation or two with reference to the matter. Mr. Varley appears to have overlooked the fact that the practice of "racing for the seal" is abolished under the new law, and that consequently B would have retained his prior date. No doubt, the provision which requires the final specification to be thrown open to inspection before the patent is sealed, is one of the many bad features of the Act of 1883, but in the case to which Mr. Varley refers, I do not see that B would have been greatly prejudiced thereby, as it was well known at the time of A's opposition to B, that A had been to Paris, where he might have consulted the specification of B's French patent, which it was to be presumed would agree in substance with that of his British application. The whole of B's misfortunes were mainly due to the circumstance that B was compelled to have his patent post-dated to the day after the date of A's patent, while A retained his original date, although B's was anterior to A's.

T. J. H.

Southampton Buildings,
Sept. 3*rd*.